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The Rock Island and Frisco Systems, as forecasted in these columns last week, are soon to reach the Gulf. Last Friday official announcement was made by the management of the Rock Island Company that there had been acquired a half interest in the Trinity & Brazos Valley, the short line bought not long ago by the Colorado & Southern to form part of its Gulf extension from Fort Worth, Tex., to Houston and Galveston, and that the St. Louis & San Francisco had acquired all the rights of the Colorado Southern, New Orleans & Pacific which is building a line, as described last week, from New Orleans to Houston. This means that the Rock Island Company, the nucleus of Rock Island control, is directly interested in railroad development on the Gulf of Mexico, which thus far has never been touched by either of its railroad systems. The new Fort Worth-Galveston line will apparently be owned jointly by the Colorado & Southern and one of the Rock Island companies—probably a forecast of the eventual taking over of actual control of the Colorado & Southern by the Rock Island Company. The value of the Trinity & Brazos Valley appears to be in its trackage contracts more than in its 77 miles of completed road. From Fort Worth south to Cleburne, its northern terminus, it owns trackage rights over the Gulf, Colorado & Santa Fe. As soon as the gap between Mexia, its southern terminus, and Houston, at present under construction, is filled in, it has the right to use the Santa Fe tracks from Houston to Galveston. Thus on completion of the 150-mile stretch north of Houston the Rock Island, the Frisco and the Colorado & Southern will be able to run trains directly into Galveston. The announcement also confirms that there is to be an extension of the Arkansas Southern, now part of the Rock Island, Arkansas & Louisiana, southward to a New Orleans connection, which the Colorado Southern, New Orleans & Pacific is to furnish. This will give the Rock Island a line from Little Rock on its Choctaw district south to New Orleans. Thus Yoakum influence is already reaching out for a hold on the highly competitive territory between Fort Worth and Galveston and a share in the traffic along the rim of the Gulf between New Orleans and Houston, so long monopolized by the eastern section of the Southern Pacific's main line.

The interchange of freight cars between different railroads is a feature of railroad business in this country which seems destined always to have its sorrows. The obstacles to orderly progress are not perhaps so big as those which trouble the Panama Canal, but they bid fair to be still prominent in the railroad world long after the canal has become a peaceful strait, with not a gravel bank in sight. The increase of the interchange car service rate from 20 cents to the more reasonable sum of 25 cents a day has been safely accomplished, and now we must resume the less pleasant task of thrashing out the diversion difficulty. There seems to be no diminution in the stream of complaints of diversion, and what to do about it will probably be the main car service question at the Chicago meeting next week. A true philosopher, sufficiently removed from the dust of the conflict—Sir Oliver Lodge, for instance—would no doubt assure us that there is no cause for despondency, even if we do have to tackle this question anew every six months or oftener. Who has ever claimed, or even supposed, that a frictionless rule for the interchange of freight cars could be devised to cover this great country, or even a quarter of it? To expect to do this business as smoothly now as it was done in 1880, would be to join the ranks of the childish optimists who think that they can establish a uniform freight classification for the whole United States. It has been proposed that every car sent into an enemy's territory be accompanied by a special notice (as is done with embargo and penalty notices) warning everybody not to divert that particular car. Why not? This seems a laborious task; but we do as much cheerfully for a shipper whenever he asks it. We talk about the fabulous sums that cars are worth when business is brisk—$5, $10 or more per car per day—and yet we hesitate to spend ten cents a day in keeping track of a car. It is unpleasant to think that "enemy's territory" is a term which sometimes means a place controlled by an amiable neighbor; but a sharp knife will cut any knot. The wholesale diverting—or defrauding—which is accomplished by dividing a road into two roads, or by sending cars on useless journeys to "break penalty" is a yet harder problem. It would not be impossible to agree on arbitrary rules to govern this matter in every important geographical district; nor, probably, to get the question before some high judicial body for a lasting settlement of the disputes which it involves. This might, however, be very slow, and there is one remedy always at hand: Send specific and determined complaints direct to the principal offenders. "Put up a fight," if necessary. With the "industrial" railroads there is still another hard nut to crack. The Illinois Northern, owned by the International Harvester Company, of Chicago, is said to owe the railroads $200,000 demurrage, and President Stickney, of the Chicago Great Western, thinks that it is best not to try to collect the money. The I. N. owns eight cars, all flats, and wants to pay at the interchange rate, instead of the regular rate of $1 a day. Surely the arbitrary car service rule has a hard road to travel. Even these difficulties need

not dishearten; but it is highly important, first, that they be settled according to the rules of equity, even if it be necessary to carry the matter to the courts, to get the benefit of trained judicial minds, and, second, that the grounds of the settlement be published in such fulness and with such clearness as to be instructive in the settlement of similar difficulties in the future. Nothing must be allowed to interfere with the stability of the general per diem rule for interchange, and its essential ally, the dollar-a-day (or higher) demurrage rule.

The trainmaster cannot praise the industrious men who are under his supervision, though he must be prompt and strict in censuring those who are lazy or blundering. This we read in a sketch on Trainmasters' duties by a New York Central trainmaster, which is printed in another column. We copy this part of Mr. Currier's article as illustrating how unquestioningly everybody takes it for granted that in railroad service commendatory words must always be weighed, sifted, cooled and revised before they are spoken aloud. The man quoted last week, who suggested otherwise, is ahead of his time. The question is whether he is so far ahead that ordinary trainmasters and superintendents cannot catch up with him. We believe not; if only those who desire to catch up will have the courage to take the step. Who has forbidden any trainmaster to commend the industrious? If the trainmaster makes his own position in the matter perfectly unassailable that is half the battle. He must be proof against the slightest word of just criticism. One superintendent of our acquaintance has been exceptionally successful in administering the seniority rule, to the advantage of the service; and good judges give, as one of the elements in his success, the fact that his men never doubt that they are going to have a "square deal." That feeling on the part of the men means much more than that the superintendent intends to give a square deal. He really carries out that intention. To do so he has to do a lot of plain talking and much patient explaining to men whom the square deal keeps down. As phrased in the article quoted, the superintendent or trainmaster who would succeed must "lay aside a law of nature," the law of sympathetic consideration for the inefficient, when they are amiable and well disposed. There is a higher law, a law of business; that if a man does not do his duties well he must make way for a better man. This, too, is a law of nature, but we do not sufficiently study this aspect of nature. One encouraging thing in this trainmaster's symposium is the statement that on the New York Central a perfunctory knowledge of the rules is no longer tolerated. A trainmaster who can say that concerning all the men on his division deserves a gold medal—at least that is the feeling that arises in the mind of one who remembers the opposite condition that prevailed among four-fifths of the trainmen nearly everywhere only a few years ago. Still another bit of trainmaster's wisdom is the clearly defined declaration of Mr. Slack that when a man is wrong he knows it. Of course he does, if he is intelligent. And the other side of this truth is that if the trainmaster does not make it plain that he also knows it he stultifies himself. And to give unmistakable evidence that you correctly estimate a man's misconduct you must punish him as the offense deserves, not as your tender feelings may dictate.

THE GOULD SYSTEM.

In past years we have devoted much space to describing the evolution of the Gould system of railroads; that curious collection of lines, rather ill assorted and ill connected, which was saved from bankruptcy in the early '90s on account of the very looseness of its organization and which now has the interesting distinction of bidding fair to own the first railroad, or group of roads under one ownership, to deserve the title "transcontinental" within the borders of the United States, while at the same time it is the worst financed and the least managed of all the great systems. The elements of strength and of weakness are so intermixed in the entire Gould situation that it is quite without parallel in its promise, on the one hand, and its defects on the other. Since 1901 the character and the aims of the system have undergone a radical change, and it is the purpose, therefore, of the present study to outline the history prior to 1901 rather briefly, in order that the connection of events may be established, and then to treat in greater detail of the events of the last five years.

In four issues of the *Railroad Gazette* in 1904 (July 29, August 19, September 9 and October 14) the growth of the Missouri Pacific system as the foundation of the Gould system was described. Jay Gould took hold of the property in 1876, when it was named the Pacific Railroad of Missouri, leased to the Atlantic & Pacific Railroad, and was in bankruptcy because the lessee could not fulfil its obligations. We need not be concerned with earlier events, from the incorporation of the original company which built the line between St. Louis and Kansas City in 1849, up to Mr. Gould's entry.

During the next 12 years the St. Louis, Iron Mountain & Southern was bought outright and the Missouri, Kansas & Texas, the Texas & Pacific, the International & Great Northern, and the Wabash were leased and then had their leases abrogated for non-payment of rental; but the Goulds kept their interests in each of these lines except the Missouri, Kansas & Texas, whether leased or operated individually, and it was doubtless this method of separate control, as we pointed out in 1904, that saved the lines from dissolution as Gould properties in 1892 and 1893.

The first period in the development of the system may thus be said to have terminated in 1892 with the death of Jay Gould and the succession of his son, George J. Gould, as the principal representative of the family. Of the four Gould roads in which Jay Gould had been a large stockholder, George Gould was made President of three: the Missouri Pacific, the International & Great Northern and the Texas & Pacific.

The second period in the development of the system, which began at this time, may be said to have ended with the purchase of control in the Denver & Rio Grande, in 1901. Between 1892 and 1901 a praiseworthy effort was made to better the deplorable physical condition of the old Missouri Pacific and Iron Mountain. The best energies of the management were devoted towards grade reduction and general betterment of the property, while at the same time certain new construction, such as the White River line in Arkansas, was began. Extensive changes of grade and alinement were made on the main line, through Arkansas, of the Iron Mountain, which had always carried heavy traffic, both of freight and passengers, but was one of the worst lines in the system to operate economically; also on the Valley division of the same road, between Little Rock and Arkansas City and between Pine Bluff and Little Rock, Kansas City and Little Rock, etc. The changes which were made resulted in the increase of the tonnage rating of engines from 800 tons to 1,300 tons between Osawatomie and Leroy; from 1,000 tons to 1,450 tons, between Leroy and Coffeyville, and from 775 tons to 1,300 tons, between Fort Smith and Little Rock.

The St. Louis Southwestern system was built up as a Gould property somewhat earlier. Edwin Gould became a director and Secretary of the St. Louis, Arkansas & Texas Railroad in 1889, and was made Vice-President and then President after the reorganization in 1891. The original property was split up into several parts, operated in harmony as the Cotton Belt. It need not be described in detail at present, further than to say that it is shown on the Missouri Pacific map as a portion of the network of southwestern lines, and adds about 1,300 miles to the system.

Russell Harding was Vice-President and General Manager of the Missouri Pacific system from March, 1900, to September, 1904, and performed his work efficiently, with entire charge of the reconstruction, which was placed under the direction of the operating department. But even with this task accomplished, the Gould system had no ends—it was all middle. There was a network of lines stretching first southeast and then southwest from Omaha through Kansas City to St. Louis and Memphis and thence into Arkansas, Indian Territory and Texas. Two long spurs ran out from this group, one of them the Texas & Pacific main line to El Paso, the other the Kansas & Colorado Pacific main line to Pueblo, Colo. But this was highly competitive territory, and the competitors had lines which stretched further east and further west. The Missouri Pacific had the Rock Island system to contend with for much of its central business; it had the Illinois Central as a strongly entrenched competitor for the north and south business, and the Union Pacific, the Atchison, the Rock Island and the Burlington all working against it for the traffic west. As the system existed in 1900, it was a tremendous possibility as yet disappointed of accomplishment.

The third epoch of development, beginning with 1901 and now in full swing, has been concerned primarily in adding legs and arms to the body of the system. The principal acquisitions and new work have been in three localities; west of Pueblo, around Pittsburg and west from Baltimore.

The first Gould names appeared on the directorate of the Denver & Rio Grande in 1901. It is probable that control was acquired gradually, as it certainly was acquired quietly, throughout a number of years. The Denver & Rio Grande and the Rio Grande Western were linked together in corporate ownership, affording a through line, such as it was, from Pueblo and Ogden, Utah, and north and

south connections from Denver and Santa Fe, N. Mex. Then, in 1903, the Western Pacific Railway Company was incorporated to build a main line some 935 miles long, with 400 miles of branches, from Salt Lake City to Oakland, Cal.

It will be recollected that the Harriman line from Utah to California starts at Ogden, 37 miles north of Salt Lake City, and proceeds west over the famous Ogden-Lucin cut-off across the end of Great Salt Lake. The old route lay around the north end of the Lake and was one of severe grades and curves. The new route is better, but there is a maximum grade of 116 ft. against eastbound traffic at Truckee, Cal. The Western Pacific goes around the south end of the Lake from Salt Lake City, crosses the Central Pacific at Palisade, Nev., bears well to the north, then turns south and crosses it again at Sacramento. The best possible route was sought carefully and painstakingly by an able body of engineers who had also the experience of the pioneers to help them. As a result, the ruling grade is understood to be 1 per cent., although the net distance between terminals is some 90 miles longer than by the Central Pacific.

In the entire conception and execution of this line Mr. Gould had to contend with the strongly entrenched Harriman interests. Even now the vital point of the Oakland terminal is being sharply contested in the courts. Six months ago it was fought out on the basis of first possession by armed bodies, as in the early days of railroad building. The cost of the work has been very great. Bonds to the extent of $50,000,000, of which the interest and a foolishly inadequate sinking fund are guaranteed by the Denver & Rio Grande system, were issued as a first mortgage on the main line. In the terms of the mortgage the Rio Grande Western Railway also agrees to purchase a sufficient amount of junior obligations to complete the work. The D. & R. G. properties receive in return a majority control of the $75,000,000 of capital stock which covers no construction cost, as the road is being built by the proceeds of bond sales. Thus at the very outset of the Pacific extension the company has thrown a great load of meaningless stock on the property, for it to carry for all time. Yet there can be no reasonable doubt that this western line is going to prove a strong and profitable adjunct to the Gould system. The recent growth and development of the Pacific States has surpassed all expectations, even of a few years ago, and the Western Pacific should amply pay for itself in local business, as the Denver & Rio Grande does, while the best energies of the other Gould roads, aided by the cordial co-operation of the Rock Island and the Burlington, will provide through traffic that cannot now be accurately estimated, but will surely be very great.

A year or so before the definite formation of the Western Pacific enterprise, steps were taken in the East to secure for the Wabash the long coveted connection into Pittsburg. The detail of the securing of this entrance was complicated, and expensive to carry out. The Goulds bought the Wheeling & Lake Erie; they organized construction companies to build a line 80 miles long through the mountains, and to bridge the Monongahela river. Then they incorporated the Wabash-Pittsburg Terminal Company to take over the securities of this aggregation. At the same time that they were fighting Harriman in the West they were fighting the Pennsylvania at Pittsburg, and every step of the Pittsburg entrance had to be bitterly contested. The desired result was finally achieved through the medium of the purchased railroads mentioned and of the West Side Belt Railway; but it was achieved at great cost, estimated to have probably amounted to $50,000,000. A contract was made with the Carnegie Company for 25 per cent. of its Pittsburg tonnage moving under certain conditions, and then was jeopardized by the actions of the lines further west in their treatment of allied interests. This, however, need not be gone into at the present time. From present appearances, the contract is going to hold good and the company will be in shape to profit by it with the completion of the West Side Belt connection, which should be effected by this summer.

The acquisition of the ancient Western Maryland was a project more novel, because separated from the Gould base of operations in the St. Louis territory. The Western Maryland, chartered in 1852 as the Baltimore, Carroll & Frederick, began building in 1857, aided largely, not only at the outset, but through many subsequent years, by the city of Baltimore, which fostered and cherished the project of an independent, paternally governed system. But the project never came to anything beyond a weak-kneed road that stretched out along Mason and Dixon's line and terminated short of the coal fields, its chance of usefulness. In 1902, Baltimore sold its interest to a syndicate that had also purchased control of the West Virginia Central & Pittsburg Railroad, in the Gould interest, and a connection was at once started across the gap from Cherry Run to Cumberland—50 odd miles of heavy construction—to enable the coal mined in West Virginia Central territory to reach tidewater over the Western Maryland without dependence upon the Baltimore & Ohio.

It cannot be said positively that this purchase was or was not made primarily and solely with the intention of giving the Gould system an outlet on the Atlantic. To accomplish this, a line perhaps 100 miles long will have to be built, through country offering great engineering difficulties, to establish a connection with the Wheeling & Lake Erie. Even if this is done, the Baltimore & Ohio will have a competing line better, probably, in every respect, and the Pennsylvania, with its slightly longer route and far easier grades, will also be in the field. Surveys for such a connection have been made, but there would be considerable difficulty in financing this line at the present time. Ultimately, it probably will be built, and the Goulds will have their own rails from Baltimore to Oakland.

The Gould system of 1906 has a purpose, which was lacking ten years ago. It stretches across the continent, save one small link, and has reinforced its southwestern stronghold with lines north, south, east and west. The organization is still loose, and the management and financing are looser, but there are great possibilities ahead, if only there can be a steady hand at the wheel, capable of steering a safe course through the tortuous channels that are opening out. Diplomacy, skill in finance, conservatism and management are the needful things—and the greatest of these is management!

THE INFIRMITIES OF STATE RAILROAD COMMISSIONS.

In a rough way and with a number of defects in the analogy the development of the commission system in its relation to American railroads has followed the precedent of the states in their relations to the central government. We have, in fact, a kind of federation of commissions, albeit infinitely varied and bound by the loosest of ties. There is the central body, the Interstate Commerce Commission, seeking new powers, wanting existing powers defined and, in a broad fashion, needing accurate expression of what we may call its constitutional functions; and, outside of it, in three-quarters or more of our commonwealths, the state commissions, acting under most heterogeneous statutes that have sometimes collided with the federal constitution, and have been sometimes in harmony, sometimes in discord with the federal commission. Both the federal and the state commissions, mainly through the medium of decisions of the courts and new legislation, are groping toward the light and seeking the ideal *ratio vivendi* with the railroads. Both have their deep problems which, as in our national and state history, have been complicated by unlooked-for events. But we are limiting this analysis to the state railroad commissions and to infirmities which have obstructed their progress—infirmities which we hope and believe in the course of time and under the impact of civic intelligence will be outgrown. To obtain a text let us take for comparison and contrast two state commissions.

The first is a commission of long standing in an old state, a commonwealth highly capitalized, and with large railroad interests. The commission belongs to the "advisory" group, but to whose advice public as well as corporative assent has given wellnigh the force of law. It is not a "political" commission and, if partisanship has touched it at all, it has been only in remote and diluted forms. Its personnel is high, its integrity and motives unquestioned, and its chairman an able lawyer, who has held his place for many years. The commission has always laid down definite policies and, in the main, followed them consistently and successfully. As advisers its members are in contact with legislative committees and new lawmaking. It has well equipped offices, with an auditorium for public hearings. Its annual reports are significant and exhaustive. Described in a single word, the commission is positive. Contrast with such a commission the "negative" commission of an adjoining wealthy commonwealth. It is a political body all of one party; two members out of three, former chairmen of partisan state committees. It has never even expressed a policy, much less tried to enforce one. Given large powers under the statutes, it has habitually left them unused. It has dodged all legislative responsibility and "trims" between the railroads and the people—even, for example, some years ago leaving to the initiative of a private citizen the printing of street railway returns which the legislature had ordered but with the printing proviso omitted. Its annual reports are colorless, incomplete and defective. Of constructive faculty it has none, and, with an exception or two, the chief ambition of its members for

years appears to have been to secure their own self-succession in the position.

If the second of these commissions could by some touch of economic alchemy be transmuted into the first and the type impressed on all the state commissions of the land, how much more easily and quickly would the commission problem be solved! But the unfortunate fact stands that the state commissions—whether advisory, regulative or clerical—taking the country through, are sampled by the second body rather than the first. The causes fall under two heads—defective statutes or defective personnel—one or both. If the creative statute is loose, weak or cloudy, the best of commissions personally becomes a vain thing. Similarly the best of statutes may be nullified by a weak, timid or selfish board. The best engineer and fireman can hardly run a decrepit locomotive and *per contra* the two, untrained or careless, may easily cripple the most modern machine of the locomotive shops.

Coming first to the flaws of mechanism, that is to say, the constructive statute, one finds its infirmities many. In a considerable number of western states it has been the product of something which, if not exactly demagogism, is near kin to it; and, although this feature has been amended and severity has been pruned either by later legislation or by the rulings of courts, enough remains to be an evil. In other states the creative statute goes to the other extreme and makes the board a mere body of clerks for the tabulation of returns—often on blanks imperfect or nebulous. As to ambiguities of statute there is hardly a state which defines the duties of its commission clearly. This flaw has continuously loomed larger as railroad consolidation has waxed, intra-state and inter-state questions become mixed and the rate question, for example, assumed new and puzzling forms. Lack of uniformity in the constructive statutes of more than forty states was, of course, to be looked for in view of divergency of local interest; but hardly the degree of it which has prevailed or the lethargy in rectifying it in so comparatively simple a matter as the organization of the boards. One must question, too, certain specific features apt to be copied by one state from another. Take, for example, the policy of imposing the cost of a commission on the railroads as a separate tax. It is, to say the least, an undignified tax, bears the earmarks of an imposition, and accents the idea of making the commission paid servants of the corporations rather than of the state—an idea which, no doubt, in some cases has had its effect on commissioners not endowed with morals or intelligence. Finally, mark the low pay of many commissions, ranging in some dozen states from $5 per day of actual work up to $2,000 a year—sums just large enough to tempt the office seeker, but far too small to command trained service.

Nevertheless, it must be said that, as regards the statutory mechanism in the states, there has been a slow but steady drift toward betterment. Partly due to the influence of the interstate commission, partly to national meetings of state commissioners and partly to the reformative pressure of evils, commission law-making has improved and moved toward uniformity. It would be a pleasure in the same degree to be able to chronicle the uplift of state commission personnels. Here the outlook is not so encouraging. Speaking in the broadest generalization the political and mere office holding motive is very much in evidence and easily enough understood. To men potent in party management the office of railroad commissioner has some very alluring charms. Saying nothing of political "influence," there are the picturesque attractions of railroading, the free rides, the family pass, the junkets of the observation car, the joy of mixing in affairs, and other and, sometimes, more sinister elements of personal vantage—all these to be sharply distinguished from the laborious, responsible and exacting detail work of the competent and conscientious commissioner. What wonder that, under existing conditions, the state railroad commission so often falls into the vat of party patronage and pelf—more so, perhaps, than other state commissions like those for banking, insurance or taxation, where required technical work is likely to be more in the foreground, perquisites fewer and less spectacular and individual responsibility greater. As secondary results, we have a number of types of the state commission—in the West too commonly the board that feels that it must answer only to popular agrarian appeal; at the East and in the midland the commission responsive to the corporation; and, in many states, a commission with the prime object of preserving a nice balance between the two and reducing itself to a cipher.

Of late years there has entered the state commission field a new set of theorems and problems imposed by the street railways—questions bearing not only on the public interest but inter-related with the steam railroads and demanding from the commissions added labors and wisdom. Probably in the near future we shall find a large majority of the state commissions taking legal purview of both steam and electric lines with a few states yielding to the temptation to create separate electric railway boards. In the end there is little doubt that the duplicated function will improve the composition of the boards, if for no other reason, because the traveling public itself, more closely related to the street railway than to the steam railroad, will be proportionately more exacting. The hundreds who take the trolley car twice a day will be a more critical group to be reckoned with than the tens who take the steam line occasionally. Increased responsibility may thus beget a higher standard of commission work; and the case will not be much altered even when the steam companies absorb the street lines and electricity leaps the gap between the two systems, for public bodies, happily, must act when fronted by questions of public convenience and safety.

The directions of immediate betterment to be desired in state railroad commission bodies are two-fold: First, as regards the creative statute, clearness, uniformity among the states, enforced responsibility and the highest qualifications which the statute can name. This should supply the mechanism. Secondly, and more important, are the forces which make for a higher personal standard, for eradication of politics and partisanship and for commissions trained, competent, in touch with legislation, versed in principles as well as practice, well salaried directly by the state, able and willing to initiate policies, brave enough to hold the scales equitably between the people and the railroad corporations and positive in temper, attitude and action. All this will doubtless, in our many states, differing much in the nature of their transportation problems, be slow and hard of attainment, touching, as it does, at many points the basic obstacles to reform encountered in the general struggle for civic purity and competence. But, with general tendencies gradually upward, improved mechanisms, methods and men in our state commissions are very far from impossible.

Rutland Railroad.

The thirty-ninth report of the Rutland is the first issued under the direct auspices of the Vanderbilt system. During the year ended December 31, 1905, which it covers, control of the road was taken over by the New York Central & Hudson River, and the authority of most of the higher officers of that road extended over the Rutland. The Rutland Railroad is made up of a number of short local lines originally independent, which were consolidated with the idea of making a through route. The road can be used both as part of a New York-Montreal line and as part of a Boston-Chicago or Boston-Montreal line. From a connection with the Harlem division of the New York Central at Chatham it runs across the international boundary line south of Montreal, which city its passenger trains reach by trackage rights. From Boston over the Boston & Maine to Bellows Falls, thence over the Rutland to Ogdensburg on the upper St. Lawrence river, and thence by the Rutland Transit Company, a lake line owned by the Rutland Railroad, to Chicago, a Boston-Chicago line is made. The weakness of the road for through traffic is that neither of these routes is the natural, shortest or cheapest way.

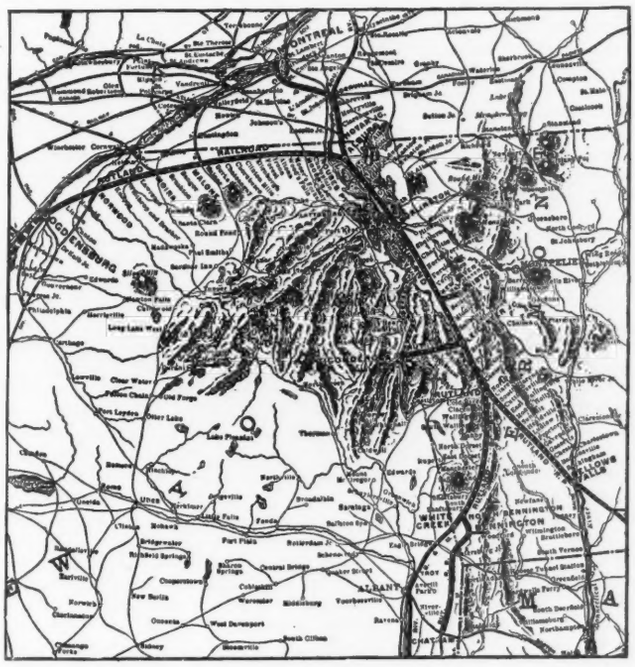
During its history the Rutland Railroad, a reorganization in 1867 of the Rutland & Burlington, has been controlled by two railroad companies which now have no interest in its ownership. From 1870 to 1896 it was leased to the Central Vermont. Default having been made in 1896, the lease was cancelled. Next the Delaware & Hudson bought control. In 1899 the Delaware & Hudson sold its interest, and, soon after, the expansion period of the road began under the guidance of Dr. W. Seward Webb. Control of the Ogdensburg & Lake Champlain had been held from 1884 to 1896 by the Central Vermont, and early in 1901 the road fell into the hands of the Rutland. In July of the same year the Bennington & Rutland was acquired, and in December the Chatham & Lebanon Valley, these two acquisitions thus bringing the road to Chatham and to within 30 miles of Troy and Albany. The Montreal connection was also built at this time and the road began to try to take a place as a through route. Dr. Webb, however, was never able to realize his ambitious plans for the road, and as a natural consequence of his relationship to the Vanderbilt family came the taking over of control by the New York Central.

The Rutland operates 415 miles of its own, and has trackage rights on 53 miles additional for passenger trains only. On this basis, freight earnings were $3,636 per mile of road, and all passenger earnings $2,158 per mile of road. No separate figures for through and local earnings are given, but these figures show how small must be the road's through traffic. With total earnings of $5,794 per mile of road, the passenger business furnished over 37 per cent. of the whole. Gross earnings for last year were $2,562,089, an increase of $125,052 over 1904. Operating expenses increased $80,283, leaving

an increase in net earnings, which were $846,486, of $44,769. Freight earnings increased $67,681, due mainly to increased tonnage of agricultural products, coal, marble and products of the forest. The increase of $38,198 in passenger earnings was due to larger local travel. After first charges and an appropriation of $100,000 for equipment bonds, there was $190,847 available for dividends, out of which 1½ per cent. ($135,864) was paid, the first payment on the capital stock since 1903, when 1 per cent. was paid.

The road's maintenance charges are low, corresponding to its freight density of 450,960 tons one mile per mile of road and passenger density of 83,354 passengers one mile per mile of road. Maintenance of way (415 miles) cost $913 a mile; repairs and renewals of equipment, $1,674 per locomotive, $370 per passenger car, and $36 per freight car. These figures show considerable changes from those of the previous year. Last year maintenance of way cost $146 more a mile, and equipment maintenance $15 less per locomotive, $116 less per passenger car, and $12 or 33⅓ per cent. more per freight car, than in 1904. The 1904 figure of $24 for freight car repairs and renewals is very low. While it is natural for maintenance of way to cost less per mile on a road with thin traffic, one freight car is very like another, and an average of $24 a car is not enough to keep equipment in shape. Even the 33⅓ per cent. increase to $36 a car in 1905 is a small figure for freight car maintenance.

The largest tonnage of any one commodity moved was of products of the forest other than lumber. Next was bituminous coal, 275,152 tons, a decrease of 14,518 tons from 1904. Apparently the New York Central has not yet succeeded in increasing from its own mines in Pennsylvania the coal tonnage of the road. The train load was 235 tons, an increase of 12 tons over the previous year. This includes company freight, and perhaps shows increased economy due to consolidation.



Rutland Railroad.

In general, it is difficult (and perhaps too soon) to trace advantages which have resulted from merging with the large system. General expenses show a slight decrease of $5,000, but this much was saved in the one item of insurance, while salaries of general officers increased from $19,300 to $21,000. Traffic returns, where benefits of the new control should sooner or later prominently appear, do not show any great gain. The trouble is that the large system has in each case its own through line better than the through line which the Rutland can afford. Apparently, as long as the New York Central is able to comfortably handle its own traffic, the Rutland will have to depend for an enlarged prosperity on increased local traffic and travel along its own line.

The principal statistics of operation follow:

	1905.	1904.
Mileage worked	415*	415*
Freight earnings	$1,509,282	$1,441,601
Passenger earnings	879,201	841,003
Gros searnings	2,562,089	2,437,037
Maint. way and structures	378,887	318,288
Maint. of equipment	329,326	319,022
Conducting transportation	923,101	908,772
Operating expenses	1,715,603	1,635,319
Net earnings	846,486	801,717

*468 miles in passenger service.

Pittsburg, Cincinnati, Chicago & St. Louis.

This road, commonly called the Pan Handle, constitutes the southwest system of the Pennsylvania Lines West. With lines directly operated, its working mileage is 1,427 miles. Its record for the past year tells the same story of general prosperity that is the keynote of the annual reports of 1905. Gross earnings increased $2,900,000, from $28,500,000 in 1904 to $31,400,000 in 1905. This is at the rate of $22,000 per mile of road, an increase of almost $2,000 per mile of road over 1904. Operating expenses increased $2,150,000, leaving net earnings of $7,897,710, an increase of $730,000 over the previous year. Net income was $3,574,200, an increase of $654,000, and surplus after dividends $1,277,000 against $635,212 in 1904. There was $1,000,000 spent out of income for extraordinary expenditures on the line, leaving a profit and loss balance of $277,000. The appropriation for betterments ($1,000,000) compares with $690,000 in 1904.

Earnings came, $22,317,917 from freight and $6,439,549 from passenger traffic earnings (not including mail and express). Freight earnings show an increase of $3,169,000, against a decrease in passenger earnings of $360,290, the latter due to comparison with the Louisiana Purchase Exposition year. Average earnings per ton per mile were 0.63 cents, a decrease of 0.04 cents from 1904; but expenses decreased 0.05 cents per ton mile, leaving an increase of 0.01 cents per ton mile in net earnings. The rate per passenger mile was 1.99 cents and the expense 2.18 cents, showing a loss of 0.19 cents per passenger per mile. The passenger figures are not absolutely conclusive owing to impossibility of pro-rating expenses on an entirely accurate basis, but they go to show why railroads in Ohio so strenuously objected to the two-cent-a-mile law recently passed.

To make up the total increase of over $2,000,000 in expenses, maintenance of way furnished $640,965; maintenance of equipment, $781,699; conducting transportation (traffic), $17,668, and conducting transportation (operation), $697,397. The largest increases under maintenance of way were in the ordinary up-keep accounts, such as applying track material, roadway maintenance, ballast, ties, buildings and grounds, etc. The rail account, however, shows a decrease of $223,168. Per mile, maintenance of way cost $2,735 against $2,291 in 1904—two very liberal maintenance figures.

Under maintenance of equipment, repairs of freight cars increased $754,787, or from $116 per car in 1904 to $124 per car in 1905. Repairs of locomotives cost $3,455 per locomotive against $3,748 in 1904, and repairs of passenger cars were nearly stationary at $1,462 per car in 1905 against $1,480 per car in 1904. These also are exceedingly liberal figures.

The number of tons carried during the year was 35,023,606, an increase of over 4,000,000 tons from 1904. The tonnage mileage at the same time increased 658,000,000 ton miles, to 3,482,500,000. Freight density was 2,440,000 tons one mile per mile of road, an increase of 456,000 over 1904. Correspondingly, freight earnings increased $2,186 per mile of road over 1904. The average train load also shows a notable increase of 44 tons, raising the figure to 350 tons; not a large figure in comparison with the Lake Shore, for instance, but, on the whole, a creditable showing.

Of the total of 35,000,000 tons hauled, there were 13,200,000 tons of bituminous coal and 9,000,000 tons of manufactures. Other mine products contributed 6,000,000 tons, and miscellaneous articles 1,700,000 tons. The traffic of the road seems well distributed, with a good-sized proportion of high-grade tonnage, which, most of all, has increased during the past year. For instance, bituminous coal carried increased 1,000,000 tons against an increase of 1,600,000 tons in manufactures.

The principal results of the year's working follow:

	1905.	1904.
Mileage worked	1,427	1,424
Freight earnings	$22,317,917	$19,148,917
Passenger earnings	6,439,549	6,799,839
Gross earnings	31,417,095	28,532,475
Maint. way and structures	3,902,858	3,261,893
Maint. of equipment	5,958,730	5,177,031
Conducting transportation:		
Traffic	666,725	649,056
Operation	11,323,987	10,626,590
Operating expenses	23,519,386	21,365,664
Net earnings	7,897,710	7,166,811
Net income	3,574,199	2,920,238
Extraordinary expenditures	1,000,000	690,058
Year's surplus	277,203	53,090

TRADE CATALOGUES.

Track Drills.—"Latest Improvements in Track Drills" is the title of a pamphlet issued by Cook's Railway Appliance Co., Kalamazoo, Mich. It illustrates and describes the line of track drills made by this company, including the standard track tool grinder.

Band and Circular Saws.—The Crescent Machine Co., Leetonia, Ohio, sends its 32-page pamphlet catalogue on saws, including band and circular types. The larger part is devoted to "Crescent" band saws, of which there are a variety of styles and sizes. In addition

to the several designs of circular saw tables, the "Crescent" jointer is also shown. Two circulars accompanying the catalogue describe the "Crescent" angle band saw and a new model 36-in. band saw.

Steam Shovel News.—This little trade magazine has for leading articles in its March number a general article on the Erie Canal and another on "The Erie Canal and Freight Rebates"; "Chinese Labor on the [Panama] Canal," and "What the Railroads Are Doing." There is also a brief description of the new interurban union station at Toledo, Ohio, and other miscellaneous matter of interest to steam shovel makers and users, contractors, etc.

Graphite Paint.—"Spring Painting" is the title of a small pamphlet issued by the Joseph Dixon Crucible Co., Jersey City. It is a seasonable talk on spring painting, particularly of bridges, viaducts, water towers, smoke stacks, gas holders, iron covered buildings, structural steel and steel cars. The protective qualities of the Ticonderoga flake graphite used only in Dixon's Silica-Graphite Paint are explained and the suggestion made that the renewal season of nature is a good time for renewing the coatings of man's handiwork.

Jacks.—Ratchet, friction, ball-bearing and cone-bearing jacks are described in a 40-page pamphlet recently issued by the Buda Foundry & Mfg. Co., Chicago. Additions to the lines previously shown are contained in the publication. Each style of jack is shown in a half-tone view and on the opposite page all of the detail or repair parts are similarly exhibited. A brief description of the jack is given, also a list of repair parts with prices.

Auto-Pneumatic Air-Brake.—A circular issued by the inventor enumerates the principal advantages claimed for certain features which he has added to the standard triple valve to improve greatly its service. The difficulties in present equipment, which his invention is devised to overcome, are given briefly, as well as an idea of its method of operation. Half-tone views of the improved triple-valve are shown. A. L. Goodnight, 115 S. 24th street, Omaha, Neb., is the inventor.

The Little Blue Flag for March, the journal issued by The Lowe Brothers Co., Dayton, Ohio, has as leading articles "Selling Paint for Profit," "Meeting Cheap Competition," "Valuable Testimony," "Varnish," and "Why Paint Peels." There are also a number of testimonial letters relative to "High Standard" paint, the company's product, and miscellaneous matter of interest.

Water Columns.—Bulletin No. 3,106 of Charles A. Stickney Company, St. Paul, Minn., describes the Johnson railroad water column. Half-tone and line engravings illustrate the device, the latter showing its design and all details. Besides a general description, instructions for setting up are given. On the final page is a repair price list.

CONTRIBUTIONS

The Muck Rake and the Canal.

Pittsburg, Pa., April 17, 1906.

To the Editor of the Railroad Gazette:

The President says in his "Muck Rake" speech: "Gross and reckless assaults on character * * * create a morbid and vicious public sentiment, and at the same time act as a profound deterrent to able men of normal sensitiveness and tend to prevent them from entering the public service at any price. As an instance in point, I may mention that one serious difficulty encountered in getting the right type of men to dig the Panama Canal is the certainty that they will be exposed * * * to utterly reckless assaults on their character and capacity."

This is quite true, and as time goes on some of the chickens of the Administration will come home to roost. When the Grand Vizir tried to destroy his Chief Engineer he said that he wished to make the situation so terrible that no other high officer would dare to resign. He was reminded that he had made it difficult for any man of self-respect to serve under him. H. G. P.

To Prevent Wear of Driving Wheel Flanges on Curves.

Prescott, Ariz., April 10, 1906.

To the Editor of the Railroad Gazette:

I have noted recently reference in your paper to excessive rail wear in rails laid upon sharp curves, but nothing concerning an excessive wear of the drive wheel flanges on the locomotives running on such track, although such must occur at the same time that the rail is being worn. The great wear of drive wheel flanges is known to the mechanical department of every railroad where there is much curved track. Such wheels must be removed often for turning in order to overcome this wear. This is expensive, on account of the cost of removing and replacing the wheels, turning the tires, and also the loss of metal, as they will stand probably but four turnings, and then the tire is useless and must be replaced. Excessive rail wear, drive wheel flange wear and danger of the sharp wheel flanges climbing the rail, all occur at the same time.

It may therefore be interesting to owners and operators of lines laid with sharp curves to know that Mr. Harry Elliott, Road Foreman of Engines, Santa Fe, Prescott & Phœnix Railway, has perfected a steam flange oiler. By his device the engineman in the cab applies a film of fuel oil to the drive wheel flanges, this being done in such a way and so small a quantity being used that it does not attach to the tread of the wheel or the top of the rail, and in no way affects the locomotive drive wheel traction. This has been in use on some of the locomotives of the Santa Fe, Prescott & Phœnix Railway for 14 months, and at no time has the oil in any way conflicted with the wheel traction. The wheels of one locomotive have made 40,000 miles without perceptible wear or suggestion of tire turning on account of flange wear. Before the flange oiler was used tires were turned after running 20,000 miles. No estimate has been made of rail wear or decreased risks on account of climbing the rail. These results were noted upon the Crown King road, where more than one-half of the line is curved, and most of the curves have a characteristic of 16 deg.

This arrangement has not been applied to all locomotives, but it soon will be. Its use on this line has not been of sufficient length to make estimates of saving in dollars and cents, but it must be very great, and it should interest every Superintendent of Motive Power and those in charge of maintenance of way where curves over 5 or 6 deg. obtain.

Mr. Elliott will be glad to give further information on this subject to any who are interested. It is not likely that the ordinary lubricating oils can be used in this way. California fuel oil so far seems to be the only oil filling the requirements.

W. A. Drake,
Gen. Supt., Santa Fe, Prescott & Phoenix.

Recent Controversy and Conditions at Panama.

To the Editor of the Railroad Gazette:

In M. Bunau-Varilla's open letter to the President, published in the New York *Sun* of March 6, he says "I appeal from President Roosevelt badly informed to President Roosevelt better informed." This is a very significant sentence. The President's letter to Congress, dated February 19th, transmitting the reports of the Board of Consulting Engineers says: "It will be noticed that the American engineers on the consulting board and on the commission, by a more than two to one majority, favor the lock canal, whereas the foreign engineers are a unit against it. I think this is partly to be explained by the fact that the great traffic canal of the old world is the Suez Canal, a sea level, whereas the great traffic canal of the new world is the Sault Ste. Marie Canal, a lock canal. Although the latter, the Soo, is closed to navigation during the winter months, it carries annually three times the traffic of the Suez Canal. In my judgment, the very able argument of the majority of the Board of Consulting Engineers is vitiated by their failure to pay proper heed to the lessons taught by the construction and operation of the Soo Canal."

On such a subject, the President is hardly qualified to express a judgment. In the first place, the friends-in-council, William H. Taft, Theodore P. Shonts and William Nelson Cromwell, are not engineers. What they have to say carries weight with the public because Taft is Secretary of War, Shonts is Chairman of the Commission, and Cromwell is an exceedingly clever fiscal agent. Their opinion in engineering matters has no weight with engineers: it should have no weight with the President. Wallace, it is plain, has been done a grave and an unrectified injustice. His successor, John F. Stevens, is incontestably an able engineer, and his sobriquet, "The Sphinx," bestowed on him by canal workmen, amounts to a testimonial in these days when Government employees, as a rule, talk too much. Stevens went to work with his mouth shut, to carry out his orders, whatever his opinions may have been as to the preferable type of canal. As indicated in his letter of Dec. 19, 1905, to the Commission, and reiterated in his letter of January 26th, his judgment favors the adoption of the high-level type. On the other hand, the judgment of the ablest canal engineers in the world, as expressed in the majority report of the Board of Consulting Engineers, is in favor of the sea-level canal. Four of these engineers have had experience solely with lock canals. M. Quellenec, Chief Engineer of the Suez Canal, is the only member of the board whose judgment might be considered biased by the circumstance that his experience has been with a sea-level canal. More than this, our American engineers have not had the experience of the European engineers in canal construction. The verdict of the foreign engineers, then, deserves to have weight with

the President, rather than the uninformed opinions of men of less experience.

In the second place, the elongated lock at Sault Ste. Marie—the "Soo Canal"—is not a canal at all; it is simply a lock connecting Lake Superior with Lake Michigan. Nor are the conditions analogous. The "Soo" is 2,330 yds. long, 108 ft. wide at the canal gate and 270 ft. at the basin above locks, and 25 ft. deep. The Poe lock, opened in 1896, is 800 ft. long, 100 ft. wide and 22 ft. deep. It accommodates vessels drawing 21 ft., and it can be filled and emptied in seven minutes. The Suez Canal is 90 miles long, with a depth of 31 ft. and a bottom width of 108 ft. The type of Panama Canal approved by the commission in its latest findings would be 48 miles long, with three locks, and would have a width of 1,000 ft. for 20 miles of its length. It is obvious that to institute a comparison between the "Soo" and the Suez Canal on the one hand, or the "Soo" and the Panama Canal on the other, might result in misleading deductions. The President's inference is illogical when he says in the same letter: "Moreover, what has been actually demonstrated in making and operating the great lock canal, the Soo, a more important artery of traffic than the great sea level canal, the Suez, goes to support the opinion of the minority of the Consulting Board of Engineers and of the majority of the Isthmian Canal Commission as to the superior safety, feasibility and desirability of building a lock canal at Panama."

The schemes for a lock or a lake canal at Panama depend for their accomplishment on big earthwork dams for the barrage of the great floods of the Chagres river. At Bohio the maximum depth to bed rock is 160 ft., through mixed and porous river detritus. The pneumatic process has not as yet been successfully operated to anything like this depth, and in the debilitating tropical service conditions it is unlikely that workmen can stand a greater depth than 100 feet. A resident engineer writes me: "The theory advanced by some that the head could be lowered by pumping is no doubt chimerical. At the site the elevation is practically sea-level, and the slight tide of the Caribbean backs up beyond it. The various schemes of Lindon W. Bates for lower dams, built after the scheme proposed by George S. Morison for Bohio and somewhat similar to the barrages of the Nile, would found the dams of earth and piling on the present valley floor, and have a great spread up and down stream with a less height, so that the filtration through the permeable material under the dam would be very slow and difficult. These plans deserve the greatest consideration, as they develop the lock scheme to the limit as the most economical and quickest of realization: but coming up at this late day it seems impossible to obtain for them the consideration they deserve—which is much to be deplored."

Another consideration not to be overlooked is the delicacy of handling necessary to get boats 700 and 800 ft. long through a lock canal. A daily object lesson is the docking of the big liners in the North river. The Isthmian waterway is not intended for a boat to *fit into*, like a hat in a hat-box, but for a ship, broad of beam, to navigate, and even (to a limited extent) to move about in. The advocates of the San Blas tunnel route seemed to be persistenly unable to comprehend that a ship foundered in a trench or a tunnel is not precisely easy of extrication. M. Bunau-Varilla's projected "Strait of Panama," to be evolved from his transformable 130-ft. level canal by dredging, has a width of 500 ft., as compared with the 200-ft. minimum (for seven miles) of the 85-ft. level lock canal of the Commission's present plan. The danger to a lock canal from malicious injury such as dynamiting has often been pointed out.

Messrs. Shonts, Magoon and Harrod, of the Commission, are not engineers; Messrs. Hains and Ernst have had no experience in canal construction or management. These five gentlemen constitute the majority which favors the 85-ft. level lock canal and dissents from the judgment of the majority of the Board of Consulting Engineers. They are scarcely qualified to choose definitely the type of canal to be decided on. What was the Board of Consulting Engineers appointed for?

The present muddle is due to "vaulting ambition that o'erleaps itself." The Commission has been in too much of a hurry; it has been too prone to count "the mortal years it takes to mould memorial forms." In consequence, Lindon W. Bates's great lake-country concept comes too late; M. Bunau-Varilla's transformable canal is pigeon-holed because for the good of "unimagined empires" he sacrifices immediate expediency to permanency.

The objection raised by opponents of the sea-level plan, that *any* canal must have at least one lock in order to allow for the difference in tides, will hardly hold. The mean tidal range for the Atlantic side is 1.43 ft.; for the Pacific side 12.6 ft. It has been calculated that this variation, distributed throughout the canal length, would give a current of about 3½ miles an hour! Any boy who owns a canoe will admit that this is not a prohibitive current.

The United States has spent on the canal to date some $70,000,000. For this expenditure we have to show 1,000,000 cu. yds. excavated by ourselves and 40,000,000 dug by the French, that apply on the type of canal we have chosen. Any sensible person who reads the reports of the Department of Health under Colonel Gorgas will not be dissatisfied with the amount of excavation already made. There is neither rhyme nor reason in the jeremiads of those who think that because dirt isn't flying there's nothing doing. "If we haven't made the dirt fly we have made the filth fly," the Chairman of the Commission sagaciously remarks. The energies of 4,000 men are at present directed to the extirpation of *stegomyia* and *anopheles*, setting rat-traps and probing crab-holes, covering roadways with gravel, draining and petrolizing swamps, fumigating houses, and peddling drinking-water. The most captious of critics can find no fault with the thorough-going work of Gorgas and his men. It is too bad, though, that a lot of highly specialized labor has had to chafe in idleness on the canal zone while the preliminary work of sanitation has been going on.

Here is an extract from a letter written early in January by one of the better-paid instrument men: "At present there does not seem to be any effort made toward actual construction, but the sanitary people, carpenters and painters have been very active the past year, and have improved the appearance of the country wonderfully . . . We are busy making small surveys and taking topography, but it is expensive work, and should be done after they have adopted some type of canal. Of course, only part of our work will be useful for any one type of canal."

Not all of the technical employees of the Commission possess the engineering qualifications of the man who wrote this letter. From the base of supplies at Washington, 2,000 miles from the firing-line, a great deal of shuffling inefficiency has been drafted into the canal service. One man who for ten years had been a government clerk in Washington got an engineering job on the Isthmus paying $175 a month, involving supervision of track-laborers. Even the Jamaica "nigger" soon learns to detect the incompetency of some of those set in authority over him, and so he either "soldiers" and shirks or becomes disheartened. "At Culebra," a resident engineer said to me when I was on the Isthmus, "the negro trackmen were often far more valuable than many of the high-priced men sent by the Commission."

In his notable article on the Panama Canal in *The Contemporary Review* for March, 1889, forecasting the French *débacle*, Mr. Edward Whymper quotes the Isthmian saying: "Only poor men come to the Isthmus." To certain discouraged resident engineers in the last few months it has seemed as though the Commission was sending to the Zone the men who have failed to make ends meet at home, the incompetents who crowd the lower rungs of every professional ladder. No more of such labor is wanted. It is costly at any price. And, working under tropical conditions of about 25 per cent. efficiency, the price of 80 cents to $1.04 for a day's labor of the lowest grade is equivalent to $3.20 to $4.16 for a whole man working a whole day. The necessary surveying has been done—no government enterprise was ever initiated with more abundant or satisfactory data in hand, and there is at present a reducible surplus of engineering talent at Panama. Along with the double-tracking of the Panama Railroad and the other problems which Stevens, with his tremendous capacity for work, cheerfully faces, is the job of eliminating the unfit—the camp-followers and hangers-on of the undertaking.

FULLERTON L. WALDO.

Washington Correspondence.

WASHINGTON, April 17.—No definite agreement on the review amendment to be incorporated in the Hepburn railroad rate bill has yet been reached. Such an agreement seemed to be in sight early last week, but the premature announcement that the President had agreed to it and the action of certain newspapers in representing this as a surrender on his part has resulted in a temporary delay. There is no reason to believe, however, that an agreement will not eventually be reached along substantially the lines indicated last week. The advocates of a restricted review still cling to the hope that they will be able to secure a majority for their proposition, but the indications are that in the end a majority will be found for an amendment based on the incorporation of Senator Knox's provision for the protection of carriers in their legal rights in the Long amendment with the addition of a provision for impounding the amount in controversy pending the review.

The notable feature of the debate during the past week has been the declaration of Senators Bailey and Tillman in favor of flat mileage rates. Senator Foraker was not slow to take advantage of this and to point out how mileage rates would affect the fruit industry of Senator Tillman's state and the cotton industry of the entire South. As the debate progresses more will be heard of mileage rates. One of the contentions of the opponents of the Hepburn bill is that whether the bill, as finally passed, shall require the Commission to make rates on a mileage basis or not, the Commission will be forced to make them on approximately that basis. This argument is based on the theory that there is scarcely a rate that can be changed without changing the relation of rates affecting rival communities, and that, consequently, practically every order

issued by the Commission will meet with criticism from shippers in some quarter. It is contended that this would drive the Commission, in self-defense, to endeavor to avoid charges of favoritism by adopting a uniform rule to be followed in all cases, and it is contended that the only such rule that could be adopted would be that of fixing rates on a given class or a given commodity at a uniform amount per ton per mile.

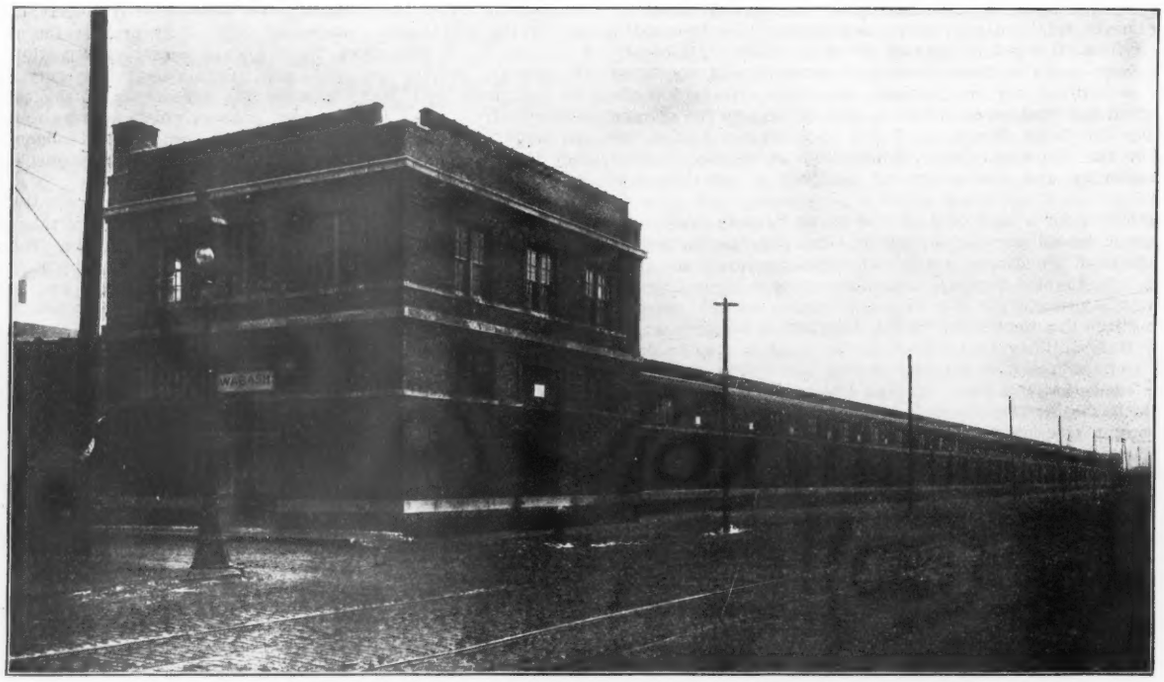
The mileage proposition has been brought to the front by the decision of the United States Supreme Court in the Michigan Railroad Tax Cases, indicating that the provision of the bill empowering the Commission to fix rates must prescribe some specific rule or definite standard so that, in theory, the rate will be made by Congress and the action of the Commission will be purely administrative and will be confined to the determination of the rate by applying the legislative standard to a specific freight condition. Of course, the simplest standard that could be devised would be one of mileage rates; but, despite the declaration of Senators Bailey and Tillman in favor of this standard, it is not at all probable that it will be seriously considered by the Senate. The chances are that the Senate will take the risk of the provision in its present form being declared unconstitutional or will endeavor to devise an amendment under which the courts can hold that the Commission is simply required to ascertain certain facts and determine the rate in accordance with them, eliminating the exercise of legislative discretion by administrative officials.

J. C. W.

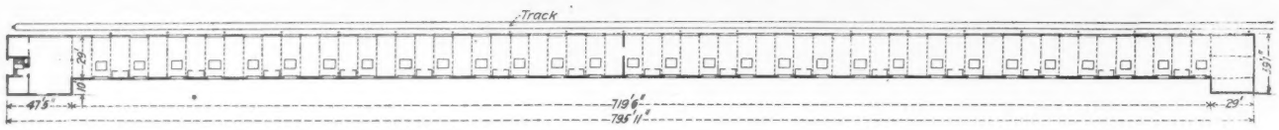
The new Italian Minister of Public Works has introduced a bill providing means for making the railroads adequate to the work demanded of them which calls for the expenditure of no less than $260,000,000, to be distributed over the next ten years. He has also submitted a bill for acquiring the only considerable railroad system (the Southern), which is still outside of the state system. The authorities have contracted with the Baldwin Locomotive Works for 20 locomotives, 10 for express and 10 for freight service, to be delivered by August next.

New Outbound Freight House of the Wabash at Chicago.

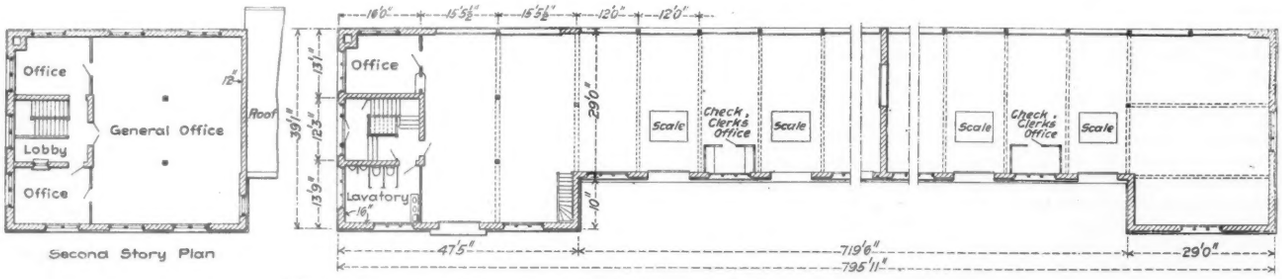
One of the most important of recent Wabash improvements is a new outbound freight house lately completed at Chicago. This is on property newly acquired on Clark street, extending from Polk to Taylor street and eastward to the alley. The old freight house of the Wabash is at Twelfth street and Plymouth Place, a short distance southeast of the new house. It was used for both inbound and outbound freight. But the business outgrew it, congesting it so that additional facilities were imperative. With the completion of the new outbound house, the older house will be used entirely for inbound business. The cost of the new outbound house is about $60,000.



New Outbound Freight House of the Wabash at Chicago.



General Plan; New Wabash Freight House at Chicago.

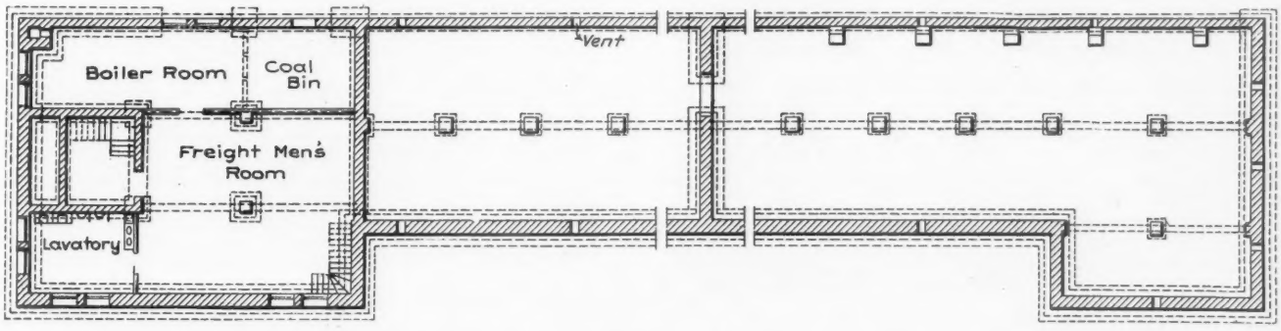


First and Second Story Plans; New Wabash Freight House at Chicago.

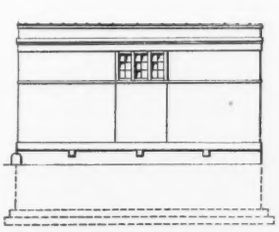
The new freight house is 796 ft. long, with a two-story office portion at the Polk street end. Plans and elevations are shown herewith. It is built of brick, the foundation walls and floor-supporting piers being brick on concrete footings. The roof is composition, supported by wooden roof trusses. The flooring is 1⅛ in. x 2¼ in. maple, laid over a 3-in. sub-floor. The basement, cold room and entrance to the lobby have concrete floors laid over a 5-in.

course of cinders. There are 30 doors each on the team and track sides and 30 scales—one for each door. There is a check clerk's office for every two scales, thus greatly expediting the handling of business. The freight section will be lighted with 17 Humphrey gas arc lamps of 500 candle power.

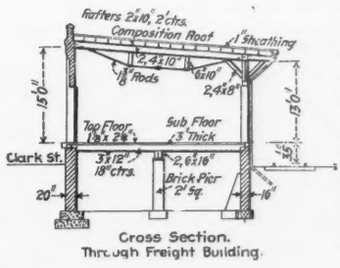
One of the most interesting features is the arrangement now being installed for service from the Chicago freight tunnels. There will be two connections from the Clark street bore, one at each end of the building, with elevators for raising and lowering the tunnel cars. A track will run lengthwise of the floor from one



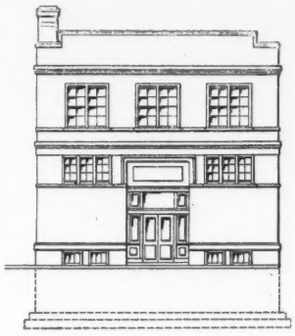
Foundation Plan; New Wabash Freight House at Chicago.



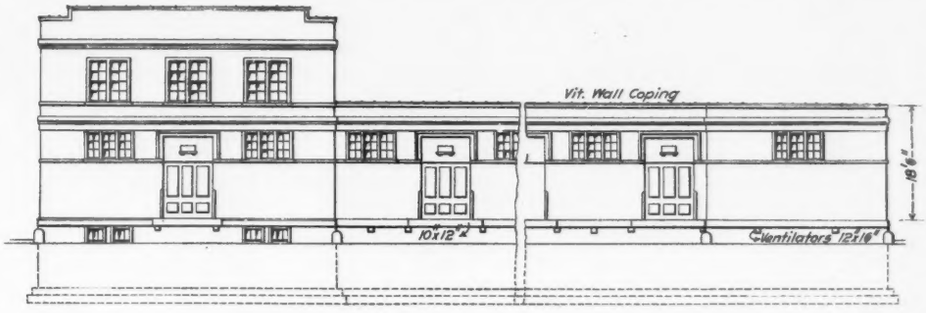
Elevation Facing Taylor Street.



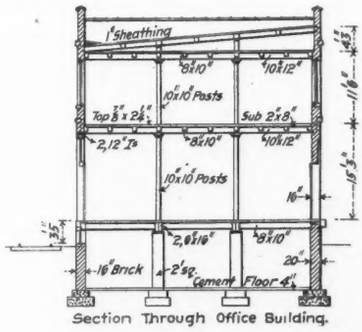
Cross Section. Through Freight Building.



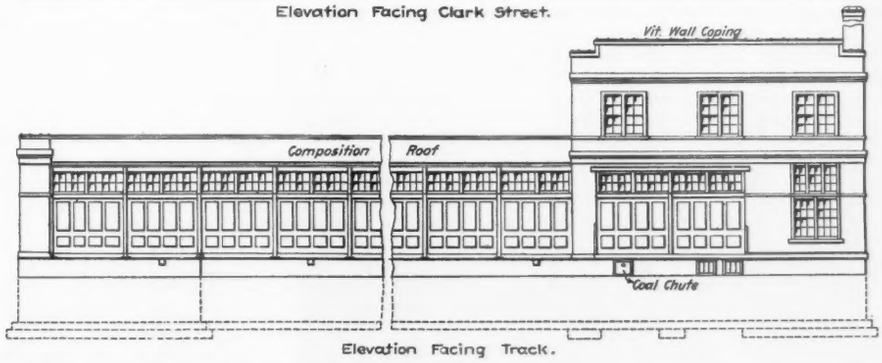
Elevation Facing Polk Street.



Elevation Facing Clark Street.



Section Through Office Building.



Elevation Facing Track.

Elevations and Cross Sections; New Wabash Freight House at Chicago.

elevator to the other. The loaded tunnel cars will be received ordinarily at the north or Polk street end, will be run out onto the longitudinal connecting track, unloaded onto the floor and continued to the south elevator for return to the tunnel. On the farther side of each elevator there will be track room to store eight or ten tunnel cars in case the elevator is not ready to handle them. There is also a runaround track by each elevator. The inbound house will have similar connections to the tunnel. The Wabash houses have the distinction of being among the very first freight houses in Chicago to have connections made for the tunnel service.

The Duties of a Trainmaster.*

He is the first one resorted to by the train crews when things do not roll along their way; he is the right hand of the Superintendent. He listens to complaints and grievances, regulates, adjusts or dismisses them, investigates sins of omission and commission resulting in poor service, and digs out evidence, fixing responsibility for accidents. To him are sent the complaints of passengers against the men, some of merit, many without, but all to be impartially investigated. He must exercise a general supervision over all employees, not only in train service but also in yard and station service on his division, keeping a watchful eye upon station buildings inside and out to see that they are kept up to a proper standard of neatness. He must be familiar with the actual conditions that govern yard and switching facilities in detail at terminals in order that no "song and dance explanation" as the boys call it be received in cases of derailment or other mishap; whether this train can get along with one less car, or the other train is being run without enough cars, watch the time and stops of trains to ascertain if they are doing the best they can, see that cars are properly and regularly distributed; keep in touch with the despatcher 24 hours a day and be ready on short call at night to get into his boots and breeches whenever there is a wreck on the line. It is a strenuous life and full of incident, but Trainmasters as a rule are a healthy lot, and are generally recruited from the ranks where

**Railroad Men*, the monthly magazine published by the Young Men's Christian Association, New York City, has in its April number an article giving brief biographical sketches of 10 trainmasters of railroads in the New York Central System, with portraits; and a number of these trainmasters have written brief articles on the duties of their offices, which are published. Herein we give extracts from these articles. The author's name is given at the end of his article, except that the name of the writer of the last one is not given.

they have learned that in order to do good work they must take good care of their bodies.

Informal meetings are frequently held where the Trainmaster catechizes his men as to their understanding of the rules; such meetings are productive of wonderfully good results; they keep the men on edge, and lots of spirited discussions take place at these times. A much higher standard of train service is required, and given, than there used to be; a perfunctory knowledge of the rules of operation was once deemed to be sufficient. Nowadays, the men are not only required to know the rules, but to understand the fundamental principle that brought them individually into being, and it is part of the duty of the Trainmaster to make that clear to them. This, however, is not a difficult task for, thanks to a system that provides intelligent men to start with, the average man in train service to-day is of somewhat superior calibre to his brethren in the earlier days of railroads. He earns more money and works less hours for it than formerly and more is expected of him in a better standard of service.

Men as a rule, no matter what they may protest to the contrary, *know* when they are in the wrong, and what good discipline requires in the way of penance, and the quality of the service is the gage that shows whether the Trainmaster also recognizes this important fact. The points of contact between the Trainmaster and his men are many. Discussion of every day matters of operation frequently develops problems that require considerable thought to solve. This broadening process is of the greatest importance; it brings out the actual knowledge of his business possessed by each man. This close relationship between the Trainmaster and the men promotes an *esprit de corps* that *really* animates, and it tends toward perfect service.—F. T. Slack, New York Central, New York.

As a Trainmaster's duties bring him closer in touch with men in train service than any other official, he should make a study of the habits, disposition and peculiarities of each man in his charge, that he may be more able to assign responsibility for accidents, detentions to trains, etc.

Since May 1, 1905, I have personally instructed over 1,500 men in train service; this includes enginemen, conductors, firemen and brakemen. To accomplish this, we hold at least two meetings each month, at which practical talks are given by Assistant Superintendent S. R. Payne and myself, our subjects being train rules and train orders. We give practical illustrations of each rule, specifying the condition or accident which brought about the requirement of the rule; and, for our train orders, we give an illustrative lecture on a blackboard.

In addition to dwelling upon train rules and train orders, we have a heart to heart talk with our men, encouraging them to give us their confidence, and assuring them that we are all one large family, in which the welfare of one means the welfare of all.

A Trainmaster should be a student of human nature. In most cases, recommendations "cut no figure," as the greatest rascal generally has the best recommendations. A Trainmaster, who is a student of human nature, can pick out undesirable applicants from their manner of dress and general appearance.

A Trainmaster must be the arbiter between the conductor and brakemen, taking care that the report from the dyspeptic conductor does not deprive the company of the services of a man who will, if given a chance, become valuable. He must, on the other hand, see that the "smart Aleck" of a brakeman does not impose upon the easy-going and generous-minded conductor.

A Trainmaster must give special attention to the prompt and regular movement of traffic, carefully investigate detentions of trains, and make frequent inspections of train equipment, books, bulletin boards and train registers, and be responsible for their condition.—Charles F. Ray, New York Central, Syracuse.

The Trainmaster is responsible at all times to have enough men on hand who are qualified to fill all places in the train service. We have on this division 134 passenger conductors on regular runs, and 28 extra passenger conductors. In the freight service we have 98 regular freight crews on regular runs. We have 90 freight crews on irregular runs. There are 58 freight conductors standing extra at the different terminals. We have 10 railroads using the tracks of the New York Central in the vicinity of Buffalo and the Trainmaster has to see that these employees are qualified for running over the New York Central tracks and has to examine them on train rules, etc.—P. W. Resseman, New York Central, Buffalo.

One is supposed to exercise general supervision over all employees in the train, station and yard service, often examining passenger equipment as to cleanliness, and see that it is such as will make a journey comfortable and pleasing; that the schedules are accommodating; that required freight cars are supplied and distributed, promptly loaded and unloaded and moved with despatch; that the motive power is sufficient for prompt and regular service, and the maximum tonnage rating maintained; that the service is only such as will meet actual requirements.

The performance of these duties requires close application at all times, day and night, the traveling of many miles, and ceaseless vigilance. A familiarity with all existing conditions of whatever nature is essential that he may act promptly when necessary. He must lay aside that law of nature which sometimes creates a personal feeling, and act toward all with absolute impartiality. He is the medium between the men and the company, so to speak, and must safeguard their individual interests between themselves. He cannot praise the industrious, but must urge the indifferent. In the interest of a common cause the Trainmaster should be frank and equitable with his men, and they equally so and honest with the Trainmaster.—W. W. Currier, Putnam Division, New York Central, Highbridge.

The duties of a Trainmaster are multitudinous, and if he is located at a point somewhat distant from the Superintendent's office, he must not only attend to his train service and men, but also the municipal and commercial interests of the company he represents.

All new work and improvements of tracks in his territory are invariably referred by the Superintendent to the Trainmaster for a thorough investigation of the conditions on the ground, and he is asked for recommendations. Being the last official to whom such matters are referred, he must work the thing out because he has no one to turn it over to and ask to "Please investigate and advise," and as far as the Operating Department goes, he is the buffer between the railroad company and the public.

In the train service, the Trainmaster is again a buffer between the railroad company and the employees in his department. He must enforce strict discipline, and at the same time be fair and impartial with his men and command their respect. His position is something like the city fireman. He must be on call at all times, day and night, ready to respond to any call in case of trouble in his territory. On some of the large roads, there is a position designated as Chief Wrecker, but usually it is the Trainmaster who must proceed to the scene of the trouble and clear the way and keep traffic moving, if any possible way can be found. A passenger conductor on the "Big Four" once said to his Superintendent in reply to an inquiry as to how he would like to be Trainmaster, "I do not care for the position, as I am better off in charge of one train than 50, and when I get to my terminal I know that I am free until it is time to take my run out again. No, I'll hang onto a good passenger train." A good Trainmaster must be born for the position as everybody can't fill it successfully, and when a railroad company gets a good one they keep him there and make superintendents out of clerks and train despatchers because the Operating Department is like a locomotive—the throttle is simple and easy to work but the steam and machinery which it controls is complicated, and requires a lot of energy, experience and hard work to keep it in order. x.

"Horseshoe" Concrete Arches.

BY DANIEL B. LUTEN.

In designing arches of concrete considerable variety is possible in arranging the ends of the arch to fit the side slopes of earth and to afford easy passage of flood-waters. The usual forms are spandrel walls across the end of the barrel and wings extending far enough to hold the earth side slopes, the wings occupying any position from parallel to the stream to parallel to the track.

A more economical type of end for arch culverts has recently become popular on many of the railroads in Indiana and Ohio, and is called the "horseshoe" arch from its resemblance to a horseshoe, as may be seen in Figs. 1 and 2. The views shown in Figs. 1, 2 and 3 represent an arch of 20-ft. span and 9-ft. opening on the Big Four Railway between Danville and Greencastle, Indiana. Thirty-seven of these arches of spans from 3 ft. to 18 ft. have been built on the Indianapolis & Northwestern Traction Ry., and 29 of the spans up to 22 ft. on the Indianapolis & Western Ry.

As may be seen in Figs. 2 and 3, the "horseshoe" end is formed by cutting the barrel of the arch to fit the side slope of the earth fill, one and one-half to one in this case, then squaring the end of the arch ring normal to the intrados, and forming a shoulder over the crown to hold the toe of the slope. The end of the arch ring is thus a warped surface of helicoidal form such as may be generated by a line having two simultaneous motions, one about the axis and one along the axis of the arch.

This type of arch is of exceedingly simple construction. No forms are necessary except the drum of the arch, extended at its lower part to the extreme ends of the proposed arch. To form the "horseshoe" end to fit the proposed slope two lines may be stretched, as shown in black ink on Fig. 4, one on each side of the arch and a few feet away, transverse to the roadway and in the plane of the desired slope, that is ordinarily, at a slope of one and one-half to one. A workman standing in line with these two lines and sighting across the two can direct the placing of the concrete

Fig. 1—Horse-Shoe Arch on the Big Four.

Fig. 2—Diagonal View of Horse-Shoe Arch.

Fig. 3—Side View of Horse-Shoe Arch, Showing Fit of Shoulder to Side Slope.

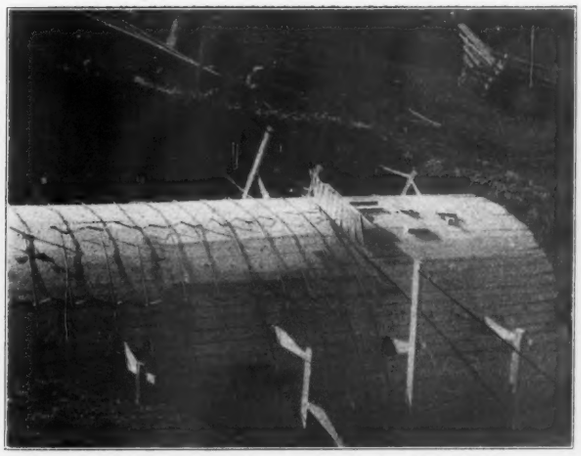


Fig. 4—Forms in Place for Horse-Shoe Arch.

Fig. 5—Concrete Arch With Wings and Spandrel.

Fig. 6—Funnel-Shaped Horse-Shoe Arch.

so as to maintain the outer shoulder at the exact slope; the end can be trowelled to the desired warped surface by working with fairly dry concrete over the crown; and its surface may be tested by applying a try square with one blade tangent to the lagging of the drum. It is sometimes advantageous in forming the part of the surface over the crown, where it is nearly vertical, to build a short section of form as shown in Fig. 4, a view of drum erected and reinforcement in place ready for concrete. A section of the centering laid flat on the drum and faced with a few short upright boards is all that is necessary to hold the concrete for an hour or two until it has hardened enough to stand trowelling, when the form may be removed and the surface shaped with the trowel. A further guide in building the warped surface may be had by laying off on the drum lagging the inner curve of the face, by holding a rule normal to the drum and locating it at a point with the required thickness of face between plane of slope and drum.

The face may be made of uniform thickness from crown to springing, but presents a better appearance if thickened towards the springings. A massive appearance may be given to an otherwise light arch by increasing the amount of shoulder and giving to the warped face a considerably thicker arch ring than the actual section of the arch back of the shoulder. Thus in Fig. 1 the arch shows at the face a thickness of 24 in., while one foot back of the face the crown is but 13 in. and increases to 17 in. of crown under the 30 ft. of fill at the middle of the track.

An arch built with "horseshoe" ends does not present as handsome or finished an appearance as the type shown in Fig. 5 with wings, spandrels and copings; but it has a very decided advantage in cost, as the saving in forms, concrete and labor amounts to from 15 to 25 per cent. of the total cost of the structure. And after a foreman has once been carefully instructed in the building of one of these ends, he can make it quite an artistic structure by forming all lines and curves truly and accurately and relying on the very simplicity of the device for its merit. The beauty of this design rests in its common-sense.

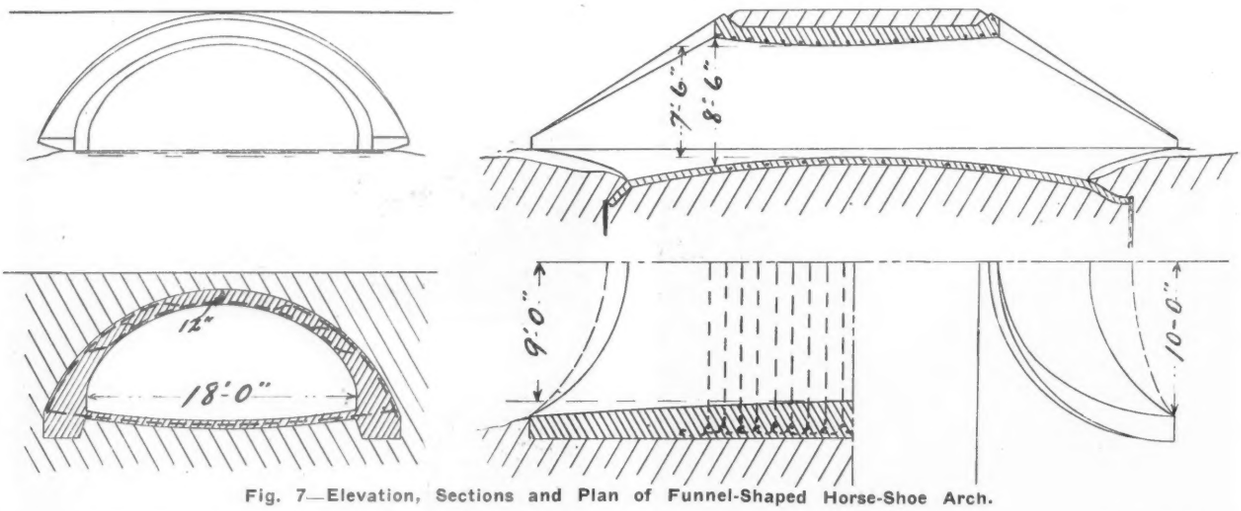


Fig. 7—Elevation, Sections and Plan of Funnel-Shaped Horse-Shoe Arch.

As to the capacity of this arch for handling floods, it is quite as effective as the spandrel and wing type where the wings stand perpendicular to the track, but is not as effective as splayed wings. The wings of the "horseshoe" arch may also be splayed slightly, however, and an arch of this type which was built especially to accommodate an excess of flood water while limited to a given span and rise, near Lebanon, Indiana, on the Lebanon & Thorntown Traction Ry., is shown in Figs. 6 and 7. The arch was designed on the principle of the Venturi tube, in which a constricted waterway produces increased velocity of flow. Ordinarily, an arch is built with straight cylindrical barrel and heaviest section at the middle of its length and with the extrados conforming to changes of section. In this arch, the heaviest section is similarly at center of track, but the intrados is splayed outwards towards the ends, both at sides and at top and bottom. The arch is of span 18 ft. with 7 ft. 6 in. opening at center line of track, while at its ends the arch has a span of 20 ft. and opening of 8 ft. 6 in. The net result is that the end areas of waterway of the arch are 20 per cent. greater than at its smallest section, and the presumption is that the arch will handle all the water that will pass the largest section by increased velocity through the constricted section. The efficiency of this 18-ft. arch is thus increased about 20 per cent. by this device.

The cost of the structure is not increased in the same proportion, the amount of material required being the same as for an 18-ft. arch with straight barrel. But considerable complication of centering is introduced, although the added labor is almost entirely in the drawings necessary for laying them out. The arch was designed for 100-ton cars, and has since its erection in 1905 been subjected to the full load of some of the heaviest locomotives on the Big Four Ry. with ballast trains. The contract price of this arch complete was $570.

These culverts were erected by The National Bridge Company, of Indianapolis, and were all reinforced with their system of a single series of rods passing near the intrados over the crown and near the extrados at the haunches and crossing the arch ring at alternate points as shown in Fig. 7. A successful method of anchoring reinforcing rods in concrete is also shown in Fig. 1 (in the quarter-foundation plan), where the ends of the rods are bent sidewise in a gradual curve and hooked over the next adjacent rod.

Key West Extension of the Florida East Coast.

BY HARRY C. SMITH.

Unexpected progress has been made to date on the Key West extension of the Florida East Coast Railroad despite numerous difficulties, and indications point to the completion of the tremendous task much earlier than the most sanguine engineers predicted at the outset. A large share of the land work across the keys has been finished, although it is less than a year since construction was actually begun and hardly ten months have elapsed from the date that a large force began work. The construction gang is about to transfer itself to the water stretches, which, for the most part, do not interpose any decided obstacles. Of course, there still remains a good deal of land work to be done in spots, but it is desirable, if not absolutely necessary, to avoid the thickets on the keys during the warmer months when the mosquitos constitute a serious menace.

For rather more than half of the 165 miles between Miami and Key West, the railroad will be over water, but only at two or three points is there much depth. In fact, it is, as Henry M. Flagler says, as much like landscape gardening as it is railroad building. Building the reinforced concrete arches is not as great a problem as is their protection from the tropical storms at the few points not guarded by reefs, before and after completion. This difficulty caused contractors to be somewhat slow in bidding and it is not unlikely, therefore, that the Florida East Coast Co. will do part of the work itself.

Four long viaducts are to be built, the longest and most troublesome being for the seven miles between Boot Key and Bahia Honda. It will stretch over water from 10 to 30 ft. deep. It was originally intended to keep to the Florida mainland as far as Cape Sable and then cross by a viaduct 35 miles long, directly to Key West, but the depth of the water most of the distance ruled out that plan. Instead, the extension is being made from Homestead southwestward over a stretch of the Everglades called Big Prairie by dredges which throw up an embankment. This, in the opinion of the engineers, is the most noteworthy work ever attempted. Only a short span will be necessary from the mainland to Key Largo at Jew Fish Creek. But shallow water in the vicinity has caused much annoyance to the fleet of construction boats, so that a big dredge has been stationed there.

Soon after reaching Largo, the surveyors found a large lake to be crossed, which had never been mentioned on the maps. Accordingly it was christened Lake Surprise. A dredge is at work there sucking up the peaty bottom of the lake, which is dumped into a hopper and then forced through big pipes supported by

The Finished Roadbed Across the Keys.

pontoon bridges for a quarter of a mile to the point where an embankment for the railroad track across the lake is being built. The only foundation the key offers at this point is mangrove roots. The sections of pipe resting on the pontoons have leather elbows to permit of flexibility. Rattling can be heard in the big pipe as the pieces of coral rock are forced through. Occasionally a large jagged piece of rock will tear through a leather joint and then the mud spurts.

The first actual construction camp at which I stopped in making a tour on the launch "Nan" with William J. Krome, principal assistant engineer, was composed entirely of negroes. It was after

A Typical Scene in the Florida Keys.

dark and they mistook the launch for the pay boat, as is often the case. The whole camp began a rythmical clapping of hands in the tents, which, from a distance, seemed like the fervent devotions of a colored camp meeting. Negroes, with a few exceptions, clear the jungles as an advance guard. They are selected because they are commonly immune to certain poisonous plants frequently found. The work is done on contract, bids by the square foot or yard being received. Such contractors make better wages than ordinary laborers.

There is another all-negro camp on Key Vaca, the only other exclusively black settlement. With one or two exceptions, the whites and negroes are carefully kept apart. At Plantation Key there is a mixture, but the negroes are isolated on one side of the embankment.

The other camps are on Umbrella, Upper Matecumbe, Lower Matecumbe, Long, Crall, Vaca (two), Summerland, Ramrod and Cudjoe Keys and Key West. The average camp roll is from 200 to 250 men, there being a constant shifting from one to another, particularly within the same division, of which there are three or four, each under the general oversight of a section engineer. From Key Largo to the Matecumbe Keys the islands lie closely together. Between Lower Matecumbe and Long Key there is a decided gap, and the same is true between Long and Estetta Keys, but in the latter case the Duck Keys intervening—merely coral points projecting above the water—will serve as anchors for the bridge work. From Bahia Honda to Key West, 40 miles, the keys again lie closely together.

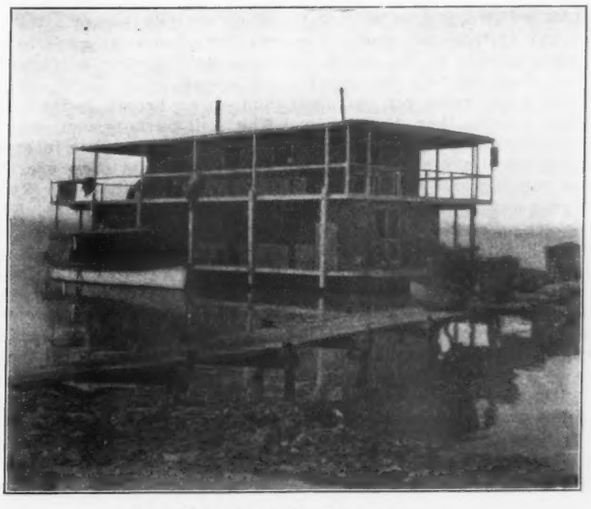
All winter the newspapers have been filled with stories of suffering and deprivation alleged by laborers from New York and Philadelphia, who went South to do the earlier construction work. Some of these complaints have already reached the courts. On the other hand, equally vehement denials have been made by officials of the Florida East Coast road. It is true that hardships existed at the threshhold of the work, but they have been so reduced steadily that the path ahead seems comparatively smooth. There was acute distress in December, because of a tremendous rainfall that month. Weather bureau reports show that the precipitation was 15.18 in., or 14.67 in. more than that of December, 1904. The average December rainfall for 18 years has been 3.13 in.

Many consumptives and infirm persons, anxious to spend the winter in a warmer clime, applied at the New York employment agencies and the same motive actuated a large percentage of the able-bodied applicants. A physical test was imposed, but it largely failed of its purpose, because many of the successful applicants either sold or gave way their tickets, while some of those who arrived at the keys had apparently exchanged good arms and legs for those of the wooden variety, during their journey. Some sort of photographic identification should have been tried.

A good many of the would-be laborers disappeared soon after the trains reached Florida. Now negroes are shipped by boat to Key West to avoid their exodus from trains at Jacksonville. Few of the arrivals brought more than a handful of baggage, and the coquina rock that covers most of the keys in the few days tore even the stoutest shoes to pieces. Living in tents during the December downpour was no joke. At the camp on the easterly end of Key West the men struck early. A big body of them marched to town, surrounded the city hall and demanded food. For two days the city fed them on the baseball grounds by public subscription. Then a local grocer offered to feed the force for 45 cents a day each, and the business men of Key West forced them to return to work. A few were kept busy on Key West streets as vagrants serving out terms. Some long ago worked out their service, but preferred to remain as boarders at the city lockup.

The construction gangs eat in long tents much in military fashion. The food while rather coarse and not served in appetizing style, has been wholesome and fairly well varied. One of the greatest problems has been the water supply. Wells on the

One of the Workmen's Camps.



Houseboat for Foremen.

keys furnish only salt water. At Key West rain water is exclusively used. So every drop has to be transported on lighters from Miami in tanks holding from 5,200 to 6,000 gallons. Eventually this water may be pumped in pipes, some of it the whole distance of 165 miles.

Several times there has been lively scurrying to prevent a water famine in some of the camps. In the same way, too, there have been dynamite and other shortages, owing partly to the fact that the railroad company was at first short of carrying steamers. Ordinary craft cannot navigate the shallow channels among the keys, so it was necessary to get hold of stern-wheel steamers quickly. An agent went up the Mississippi and bought boats at St. Louis and points further north. Several launches, pressed into service, were found to have slow and uncertain engines that had to be replaced, so the only wonder is that the confusion has not been greater.

As things stand at present, the commissary stores at the camps run by a Miami grocer offer the greatest field for improvement. There has been little sickness and few accidents considering the carelessness of many of the men. The money derived from the commissary privilege by the railroad company goes to the support of the camp hospitals and the general institution at Miami.

As something like ten tons of dynamite are used each week for blasting, the question of storing the explosive is important. One boat, so far, has carried all the dynamite from Miami to the two or three lighters, kept as magazines a couple of miles off shore with a watchman aboard.

A day's work consists of ten hours, starting about 6 a.m. and ending at 5 p.m. Many are put drilling for dynamite blasts by steadily dropping iron rods into the coquina rock. Others shovel, while still others work with wheel-barrows or drive mule carts. A channel wide enough for a small river is blasted along the surface. The rocks and gravel thus obtained are then thrown up at one side, forming the railroad embankment.

Liquor is strictly prohibited on the keys and the men get along without it surprisingly well. The conchs from Key West, however, have found it profitable to start "blind tigers" at several places, for which they were severely punished. Defying one of the camp overseers, these offenders came near having a floating bar dynamited.

Construction trains will probably be running from the mainland to Key Largo within a twelve-month, and inside two years the ends of this wonderful oceanic railroad are likely to be in operation, with temporary boat connections across the long water gap at Bahia Honda.

New York Subway and George S. Rice's Views.*

Of the New York rapid transit railway, 24.6 miles, only 18 miles at present are operated, and at this particular time it is carrying very nearly 500,000 passengers on week days, and at times as many as 530,000 passengers.

The great trouble found in operating the Subway railroad has been to accommodate the crowds in the rush hours, that is, from 7 in the morning till 9, and from 5 until 7 in the afternoon. At some of the stations during these hours it is an unusual occurrence for a passenger to secure a seat on entering a car.

The remarkable point about the operation of this railway is that in the rush hours eight-car trains are being run every two minutes. The express service continues all day long on week days, from 6 o'clock in the morning until 12 o'clock at night, during which time no interval of express train service is greater than five minutes. There is also a local travel on entirely separate tracks every two or three minutes. Of course, the schedule is made to fit the requirements of the travel. The Sunday travel is very much lighter, about one-half the ordinary day travel.

The local trains run all night, and on no branch is there an interval greater than 15 minutes. The four-track system, which comprises the lower six and three-quarter miles, has a train interval of about seven and a half minutes. This means that there are 760 trains running each way during the 24 hours, and that over 8,000 cars pass any station on the four-track section each 24 hours. The passenger miles per day equal 1,125,000; the car mileage is 108,860, and the train mileage is 19,106. The average express speed is 25 miles an hour. At rush hours it varies from 20 to 21 miles, and at other hours it reaches a maximum of 27 or 28 miles. The contract called for 30 miles, but the curves—and Broadway apparently it not very crooked—have cut down that speed. It is not considered safe at the present time, nor will it be, I think, to run those cars at a speed of 30 miles an hour. The average local speed is 16 miles an hour, including stops. The rush hour speed is 13 or 14 miles per hour, and at other times it is about 18, sometimes 20. From Brooklyn bridge to 157th street the schedule time is 27 minutes, and from Brooklyn bridge to 145th street in Harlem, it is 27 minutes, and on the four-track section it is 16 minutes.

*Extract from an address by George S. Rice, Chief Engineer of the New York Rapid Transit Commission, delivered before the New England Railroad Club at Boston, Feb. 13.

When this plan was laid out in 1895 the transportation interests which were consulted and which were accustomed to handling large bodies of men, looked with suspicion upon the four-track system with reference to transfers. They said that the ordinary person would be inclined, if he entered at Bleecker street, and wantd to go to 103d street, to remain on the locals rather than transfer to and from an express train, although it would take him a little longer. The fact is that people will transfer to save two minutes, and this has made a good deal of trouble, for the reason that the movement from train to train has been so great that the service has been very much impaired.

The average stop of an express train at an express station has been about 45 seconds, and the average stop of a local train less than 30 seconds. An endeavor was made to get the contractor, when adopting the plans for the equipment to operate the road to have side doors, not the side doors you have here in Boston, which are central side doors. The New York man is "wedded" to a side seat; that is, to seats which run against the direction of the car. It was suggested to the operating company to adopt a door which would be 6 or 8 ft. distant from the end of the car, and have no vestibule, but this was not considered practical, from a question of operation, as it was thought too many men would be required to operate these doors; this view I am not in accord with. I think that to have a very wide door is something absolutely necessary in handling the trains in New York, so that the passengers can go in and come out in a very short time, as an average of 45 seconds is too great. In some cases the stop has been as much as 90 seconds at some of the express stations.

The track is 100-lb. rail, and is ballasted in broken stone with the ordinary tie. There is another difference which we had with our contractor. In the beginning, in studying this problem of the track, we laid out an entirely different kind of track. We did not want to use ties; we did not think it was necessary. We were underground, with no frost, and there did not seem to be any reason why we should use a tie or should use ballast; we wanted to use concrete. We had constructed in Long Island, near Jamaica, an experimental section of track which was used for one winter, and it showed up very well. My own idea is that we should have a solid track, and I think that we are coming to it now.

The track, however, is admirable. I do not know an easier running road. It has been a success, but, of course, the cost has been very great to maintain it under the traffic of heavily loaded express trains, eight cars long, and running at great speed almost continuously from the beginning of the year to the end.

The greater portion of the subway already built is constructed by the use of steel columns between the tracks. About three years ago we tried the concrete construction, reinforcing the concrete by steel bars, and this form of construction we have latterly followed. In the new subways about to be built we are going to use the reinforced concrete construction almost entirely, getting rid of the posts from one end of the road to the other. All trains going in one direction will go in a subway by themselves, and not only assist in moving the air, but in case of a derailment there will be solid walls at each side.

The largest station on the railroad so far built is the Brooklyn bridge station. That has something over 24,000 square feet of area of platform. At this station are collected every week day almost 60,000 fares, 135,000 people using the station daily, being at the rate of nearly 50,000,000 passengers a year. The Brooklyn bridge itself, which is almost over the station, has a daily passenger traffic of somewhere in the vicinity of 300,000 passengers a day. On the line of the subway in operation at the present time there are 48 stations, some of them elevated but most of them subway, and three of them with elevators. One has an escalator operated on the same movement, that is, the people going up will be on the upper part of the escalator, and those coming down will be on the under side.

Mr. John B. McDonald was the contractor for the road we call Contract No. 1, that is, the one in Manhattan and The Bronx. The Brooklyn extension is called Contract No. 2. Mr. McDonald bid for Contract No. 1, $35,000,000. He practically took the engineer's estimate of what the work would cost, and made his bid on those figures.

In the construction of that work there were over $2,000,000 worth of changes required in the sewers and in water pipes. The rock was over a million and a quarter cubic yards, and the earth over two million cubic yards, making over three million and a half cubic yards of excavation.

There were 62,000 tons of steel. The work was designed by the engineering force of the Rapid Transit Commission, laid out and superintended by it, and constructed by the contractor, through sub-contractors, very carefully selected amongst men who had had a very large experience in all classes of work. The inspection of the work was rigid. The steel and iron were very carefully tested by inspectors who spent their time at the mills. Not only were there chemical tests, but a complete inspection from beginning to end was carried through. The testing of the cement has, I think, done more towards the raising of the standard of Ameri-

can Portland cement than any other enterprise in this country.

The contract time was four and a half years. The work was carried out within a few months of that time, with the exception of a section north of Fort George, where the contractor was delayed on account of the city authorities not giving consent to a slight change of route. When the work was originally designed in 1897 or 1898, the section of the city north of Fort George had not been laid out into streets. It was the purpose of the Commission to make the cost of the road as small as possible, and for that reason it was laid out through public property. When the route was deflected at Fort George to the west, it was so deflected because there was a street there. But after the contract was let, the city laid out the section north of Washington Heights (the Dyckman meadows) into streets, and the route was changed, and certain procedure followed as prescribed in the legislative act. The old route had to be abandoned, the new one required the consent of the abutting property owners, and it was then passed upon by the Board of Aldermen. When it went to the Board of Aldermen they were told that the city would save $75,000 by the change and that it would be a benefit to the road. The Aldermen waited nearly a year before giving their approval, and the work necessarily was delayed on that account.

The Rapid Transit Railroad in Manhattan includes three tunnels, one near 42d street underneath the present surface car tunnel, south of the Grand Central station; another under Central Park, and a third under Washington Heights. The Washington Heights tunnel is the longest two-track tunnel in this country, with the exception of the Hoosac tunnel.

In the operation of the road sidings have been provided at certain places, for instance, near 96th street, 72d street, 42d street, 14th street, Spring street and at Chambers street; and there is a loop for the local cars at Brooklyn bridge, called the City Hall loop.

An important feature of the road has been the storage track under Broadway, from about 138th street to 144th street. At that place there are eight tracks, where cars are stored, and easily handled for commencing service in the morning, the idea being to have a distributing point very near the middle of the line. Other yards for similar operation are at termini of the road, one at Van Cortlandt Park, another at Bronx Park, and one at the end of Lenox avenue, at 150th street.

Various new routes and extensions are now projected. The Commission last May laid out work to the extent of $300,000,000, embracing about 165 miles of new lines, principally subways. Within the next few months, three of those roads will have been presented to the Appellate Division. One of the necessary modes of procedure is to get the consent of the property owners. In Manhattan it is almost impossible to get 50 per cent. of the abutting property owners to so consent. That being the case, to protect the general public the Appellate Division appoints Commissioners who decide whether on account of such consents not having been obtained the road shall be authorized. That procedure is now being gone through in reference to the three routes, above referred to, which will incolve an expenditure of about $100,000,000. The operating company now interested in the merger, that is, the combination of the New York City railway, the subway and the elevated roads, will possibly supply the money for those three roads. Whether they will go any further or not in providing capital is a question. It is expected, however, that half of the $300,000,000 estimated for all contemplated new lines will be supplied by the companies bidding for the contracts.

The new construction, as I was saying, will be entirely different. Of the five lines which have been laid out in Manhattan, no line has a tangent less than 4½ miles long. The longest line has a tangent of about seven miles. Of course, in New York there are long avenues, permitting lines to be readily laid out. They will all be four-track roads, and constructed on the same principle as the present subway, as far as four tracks are concerned. It is probable that the express stations will be a mile or a mile and a half apart, which principle will be carried out because it has been found to be a success.

The present power house, at 59th street on the Hudson River front, has a capacity for running not only the present rapid transit system of 24.6 miles, but is also capable of handling some of the proposed extensions. Mr. McDonald when he made his original bid for the whole work, $35,000,000, estimated that his equipment would cost him about $8,000,000. The contractor was to supply his own equipment. The city merely had that portion under contract which would eventually come back to it, the principle being that the equipment would belong to the contractor and that he would give a lien on that equipment to save the city against any loss in case the enterprise did not turn out properly. The estimate, as I have said, was $8,000,000. The contracting company has already expended on the equipment $24,000,000, three times the amount that was originally estimated. It was, however, done for a purpose, as it was predicted that traffic in the future would be by underground travel. Therefore, the Commission has objected to any extension of the elevated lines; it considers that any elevated line in the central part of the city is a step backwards. Of course in the outlying districts elevated roads have been laid out, but not in the central part of the city.

DISCUSSION.

Professor Swain.—It is astonishing to consider the growth of street railway transportation. Just ten years ago this year the first subway operated by electric power was opened, that in Buda Pesth, and one year later our Boston subway was opened to Park street. All of us who have seen the New York subway have had occasion to feel very proud of that magnificent piece of work, and yet I think it is safe to say that the construction of the subway in New York is an easy piece of work to what it is in Boston. In New York there are not the crooked streets that we have. . . . In the matter of cars, it has always seemed to me that the best kind of a car was one with two doors on each side, as Mr. Rice says, about a quarter of the way from the ends of the car. I was interested to hear Mr. Rice say that the headway of their express trains was two minutes. I should like to ask him whether he thinks that it is practicable to operate either express or local trains at a smaller headway than that. In a report which the Boston Transit Commission recently made to the Legislature we assumed two minutes headway, that is, 30 trains to the hour. When the Washington street tunnel is open and the elevated trains are transferred to the tunnel they expect to operate eight-car trains, and they will probably be operated on as short headway as can be found practicable.

The growth of traffic in a city is something which is perfectly amazing. I noticed from what Mr. Rice said that the average number of trips that each inhabitant of New York makes in a year is about 300. The traffic grows a great deal faster than the population. The population will double, perhaps, in 30 years, and the traffic will double in 12 years. In other words, each year the number of trips that each person makes, man, woman and child, increases. That is natural, because the greater the facilities the more people travel.

The traffic in the rush hour is an important question in studying the problem of urban and interurban transportation, and I should like to ask Mr. Rice if he can tell us what in New York is the ratio between the traffic in the rush hour and the average hour during the day. We were accustomed in Boston to assume when we first studied the problem about ten years ago that the number of people carried in the rush hour would correspond to carrying the whole traffic in the day, in ten hours, that is to say, in the rush hour there would be one-tenth of the whole traffic in the day in one direction. I think that is perhaps a reasonable figure, and yet I notice in the recent report in regard to London traffic it was found there that in the rush hour there was about 16 per cent. of the total daily traffic; in other words, in one direction in the rush hour there was one-sixth of all that went in the whole 24 hours in that direction. That is a very large proportion, and I am interested to find whether that bears any relation to the size of the city, and whether it is increasing or decreasing as electric transportation is becoming introduced more and more.

Mr. Rice.—The headway on the New York express service is limited to practically two minutes; it may be a little less. I noticed about a week and a half ago four trains came in a little more than a minute and a half apart, but that was in the rush hour, and they lost their speed a little later as they went up the line. In our new alinements we have as straight lines as possible, and less headway can be had between trains, because we will have better control of the trains. The block system for express service is such that it is almost impossible for two trains to come together. If the motorman overruns his signal, his power is not only cut off, but the brakes are put on. Under such conditions it is not possible for a collision to occur for the reason that the blocks are so arranged that, with a train running at a speed of 35 miles an hour, the lap is sufficient when the train strikes a trip to stop before it can reach the next train. I think that in the operation of our new lines that lap can be very much diminished, and in that way the headway can be diminished, particularly as we have those long seven mile tangents, which I think will be one of the features of our new construction.

Replying to a question, Mr. Rice continued: The heat in the subway was the only part of the work for which we did not make any calculations. The temperature of the subway has been raised about 14 deg. on account of the liberation of heat, due to the use of electricity, and, of course, also to the braking of the trains on account of the friction, but it is mainly from the electricity itself. When the subway was designed we made no provision whatever except to look out for a system of ventilation or cooling, so that when we were to put that system in we would not be handicapped in the construction of the work, and therefore, made a point to have as few openings as possible, so that we could draw the air in and force it out at the stations themselves by the movement of the trains. We have analyzed the air and have been making experiments since last June. Practically we are burning, by the liberation of heat from electricity, from 96th street to Brooklyn bridge, 18

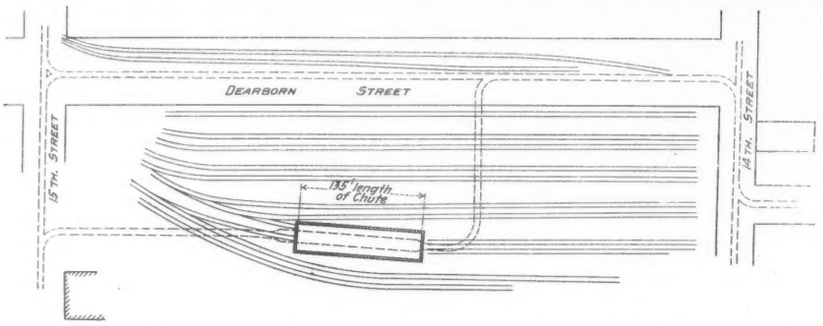
tons of anthracite coal a day, and to counteract that heat we have to institute some method of cooling. We have several ways of doing it. I am to make a report to the Commission in a short time on this very complicated problem. When we reduce the heat, which is one of the chief ventilating mediums, we introduce some complications into our problem which will have to be taken care of. We have found in regard to the air in our New York subway that as far as the oxygen is concerned the outside averages 20.71. We have made in the subway a number of experiments, and the average is 20.6, a variation of about 11 parts in 10,000. There is practically as good air in the subway as there is on the outside. The lowest oxygen that we have found in all our determinations has been 20.25. In the carbon dioxide examinations, we have about the same result: subway 4.81, outside 3.67. The maximum was 8.89.

The dust problem is a serious one, though not so much now as it was in the beginning of operation of the road, when everything was new. We originally intended to have no ballast track, but to have a perfectly smooth concrete track, where it would be readily cleansed; is was a mistake, I think, to put in the ballast track. This last winter we have had very little trouble, but we have had some examinations made, and have found that of the dust which is collected 60 per cent. is iron and one part is oil.

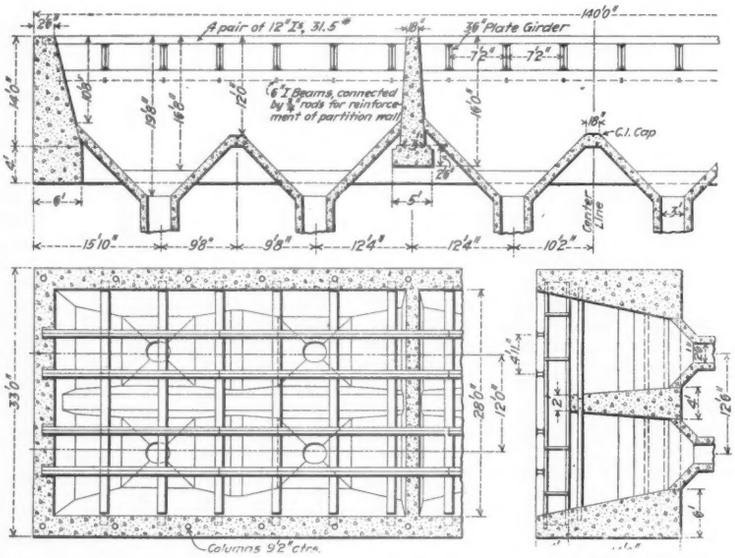
The oil has been the cause, and, in fact, almost the only cause, of the odor in our subway. We used a mercantile oil which was not what it should be. All the machinery was new, and it was deluged with oil. There has been attention paid to that matter and the odor has almost entirely been eliminated.

teenth and Fifteenth streets just west of Dearborn. Both are of 5,000 tons daily capacity and are similar in principle, differing only in the details necessary to adapt them to local conditions.

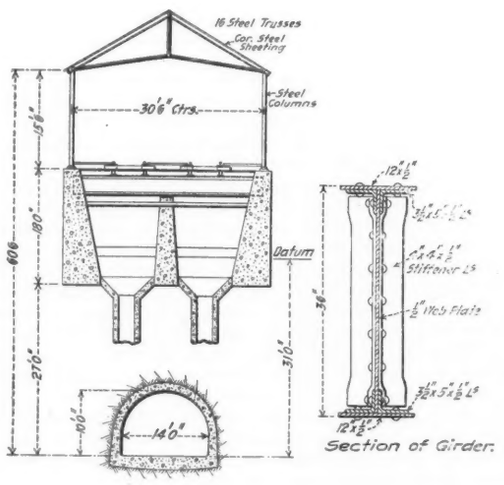
Taking the C. & E. I. yard as typical, it is seen to be a double-track arrangement having under each track three large underground chambers, built of concrete, with concrete separating walls. The total length of the plant, out to out, is 140 ft. and each chamber is 45 ft. long. The width is 30 ft. 6 in. outside and the distance between track centers 12 ft. Each chamber is double hoppered at



Plan Showing Location of Covered Chutes in C. & E. I. 14th Street Yard.


A pair of 12" I's, 31.5#
36" Plate Girder
6" I Beams, connected by ⅝" rods for reinforcement of partition wall
C.I. Cap
Center Line
Columns 9'2" ctrs.

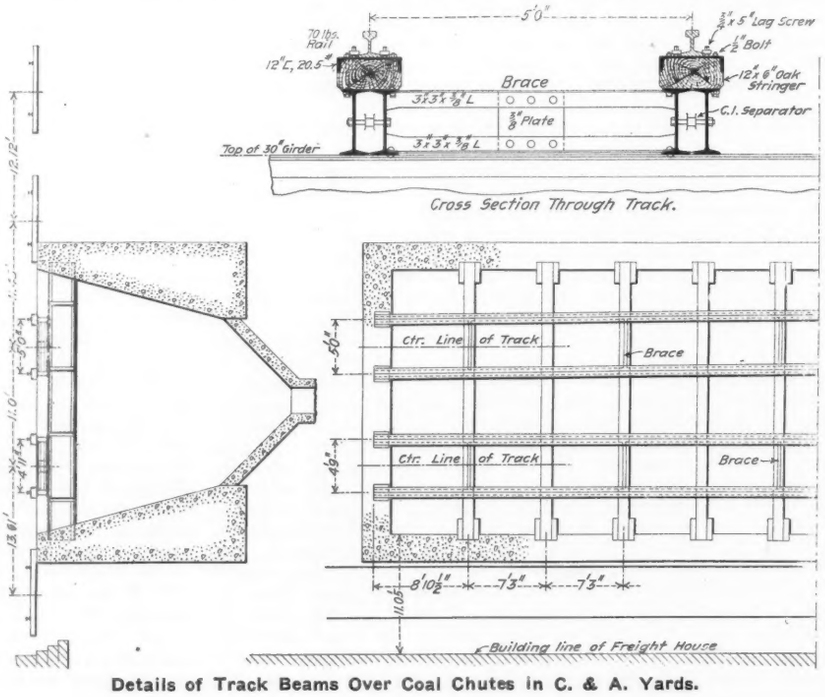
Plan and Sections Through Gravity Coal Chutes in C. & E. I. Yard.



Cross-Section Through Shed in C. & E. I. Yard.

Coal Loading Facilities of the Chicago Freight Tunnels.

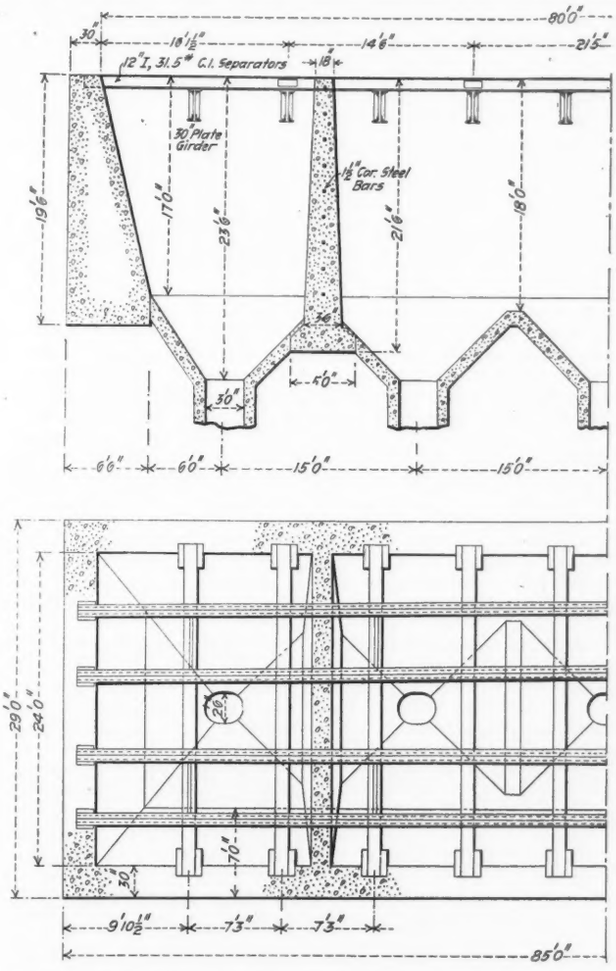
One of the functions of the Chicago freight tunnels will be the delivery of coal to the large down town office buildings, stores, hotels, etc. To obtain this coal directly and expeditiously requires special facilities at the yards of the important coal roads for delivering the coal from the railroad cars direct to the tunnel cars. These facilities consist of special chutes into which the railroad dump cars deliver their loads for discharge into the tunnel cars. The chutes for the Chicago & Alton and the Chicago & Eastern Illinois are illustrated herewith. The Alton chutes adjoin the freight house on Van Buren street just east of Canal, and the Eastern Illinois chutes are in the Fourteenth street coal yard, between Four-



Details of Track Beams Over Coal Chutes in C. & A. Yards.

the bottom and from the bottom of each hopper a chute 14 ft. long leads down to the tunnel. These chutes are elliptical in section, 36 in. x 30 in. for the long and short diameters respectively. As shown by the location plan, a special tunnel connection is made for this yard, running from the Dearborn to the Fifteenth street bores and enlarging to a width of 14 ft. to provide space for two tunnel tracks where it passes beneath the chutes. The center line of the bore coincides with the longitudinal center line of the plant above and the elliptical chutes are given an inward inclination as they descend, to make connection to the tunnel. Delivery of coal to the tunnel cars is controlled by special automatically-closing valves at the bottoms of the chutes.

The track is supported on 36-in. transverse plate girders 7 ft. 2 in. on centers. These girders are 30 ft. long and have their ends embedded in the side walls of the chambers. They also rest on the top of the longitudinal concrete partition wall, which is reinforced by transverse 6 in. I-beams placed directly beneath the transverse girders and having their ends similarly embedded in the side walls.



Plan and Longitudinal Section of Chutes in C. & A. Yard.

These I-beams are connected together by ¾ in. rods embedded in the partition wall. On top of the transverse girders are 12-in. I-beams bolted together in pairs with cast-iron separators between. The ties rest on these I-beams and each track rail is directly over a pair. The distance from top of track-supporting I-beams to top of elliptical chutes is 19 ft. 8 in. All detail dimensions are given on the drawings.

The Chicago & Alton plans as shown represent an enlargement of the original plant put in some time ago, it being the first installation of the sort. There were formerly three chutes, and two more have now been added. This, like the C. & E. I., has two railroad tracks, but unlike the latter the conduit beneath is single track. There is no longitudinal partition wall and there are therefore five chutes for discharging the coal to the tunnel cars, against 12 for the other. Also, the chutes are circular instead of elliptical. The track-supporting girders are 30 in. deep, and instead of ties the rails are laid on longitudinal 6 in. x 12 in. oak stringers protected on top by a 12 in. channel, flanges down. The rail-carrying 12-in. I-beams are connected across by stiffening braces or struts as shown in the detail. The transverse partition walls between chambers are reinforced by 1½-in. corrugated steel bars, anchored into the side walls by plates on their ends, as shown in the cross-section. The storage capacity of each of the double-chute chambers is about 300 tons, so that about 750 tons of coal can be dumped into the plant at one time for withdrawal by the tunnel cars. The storage capacity of the C. & E. I. plant is about 900 tons.

Connection to the Alton chutes is made from the Van Buren street conduit by a loop, one side of which passes directly beneath the chutes. The bore is only 6 ft. wide, providing therefore for a single tunnel track as already mentioned. From the inner portion of the loop a connection runs southeasterly to Harrison street, passing the plant of the Chicago Edison Company, for coal delivery. Because of the single-track bore, permitting only five cars to be loaded at one time, each chute branches at the bottom, giving two outlets for delivery at both ends of a car and thus enabling quicker loading. The C. & E. I. plant can load 12 cars at once. The cars have a capacity of about six tons.

Both plants are floored over between tracks. The plans contemplate in each case a shed overhead for protection. For the C. & E. I. this is shown as a steel-frame, corrugated galvanized iron construction. The Alton will probably put in an umbrella shed. The latter plant is practically completed and the C. & E. I. plant will be ready within a month. We are indebted to Mr. Geo. W. Jackson, Chief Engineer of the tunnel company, for the plans.

Spanish Railroads.

The Spanish nation has progressed considerably, beginning with the restoration of the monarchy in 1875, but more strikingly since the Spanish-American war in 1898 and the consequent loss to Spain of her colonies. The budgets show a yearly surplus of $10,000,000 to $12,000,000. Of the floating debt of the treasury to the Bank of Spain, amounting to about $280,000,000, only $80,000,000 remains unpaid. About $200,000,000 has been repaid out of the surplus and by means of issues of 4 and 3 per cent. treasury bonds, chiefly subscribed to by the Spanish people. The gold premium has fallen from 115 per cent. in 1898 to 23 per cent., with a present tendency toward par value. The 4 per cent. national debt bonds (consolidated) are quoted at about 93 on foreign markets, whereas they stood at about 29 during the American war. Spaniards have, since 1898, invested $40,000,000 in their own merchant marine, $45,000,000 in sugar factories, $150,000,000 in electric plants, mine development, and other industries. A new spirit of commerce has arisen all over the country, this being reflected in agriculture and industry, and the approaching marriage of the King with a Protestant princess, niece of the King of England, is a distinct departure from the old exclusiveness.

Spain begins to appreciate at last the enormous natural resources of her soil which have been permitted to remain dormant so long. In fact, a new era of push and enterprise has begun, but what stands in the way of quicker development is the lack of up-to-date means of communication, especially as far as railroads are concerned. Not less in importance is the question of irrigation and cheap power, such as electricity, steam, and water. Those three branches of business are, I believe, three great possibilities open to foreign technical experience and initiative, which qualities Spaniards do not possess, but which they are anxious to receive from other countries and to support with the money and everything else required.

All the main railroads radiate from Madrid, which is located nearly in the center of the Peninsula. To the north and northwest they run from the capital to Bilbao, Santander, Gijon, Corunna, Vigo and Irun; the last named place is on the French frontier and this road is the main line from which the other five roads branch. The main lines to the south and southeast go to Seville and Badajoz, which is near the Portuguese frontier, and from these branch roads run to Cadiz, Huelva, Malaga and Almeria. To the west, Madrid is connected with Caceres, near the Portuguese frontier, and to the east and southeast with Saragossa, Barcelona, Valencia, Alicante and Cartagena. There are also some important main lines between other cities. About 60 per cent. of the total mileage in the country is comprised in the North Spanish Railway Company, controlled by the Franco-Spanish Company, and in the Madrid-Saragossa Company, controlled by the Rothschilds. All the other systems are more or less tributary to and dependent upon these two groups whose control has always remained in Paris, the lines having been built largely by French capital. The North Spanish system is 2,291 miles long, and its annual gross earnings are about $25,500,000. The Madrid-Saragossa system is 2,187 miles long with gross earnings of $21,000,000. Of the other companies, the most important own the lines from Madrid to Caceres and Portugal, the Aragon Railroad and roads in Andalusia and southern Spain. These independent lines do not touch all the districts in their territory rich in mines and agriculture, the resources of which, in consequence in lack of communication, cannot be made available. According to official statistics, 700 towns with 3,000 to 24,000 inhabitants are without any railroad service. This lack of railroad facilities is being remedied to some

degree, and English and Belgian initiative in this respect is gradually making itself evident by the railroad concessions that are being from time to time secured from the Government by representatives of those nations.

About 7,000 miles of the existing lines have a 5-ft. 6½-in. gage; there are 1,000 miles of 3-ft. 8-in. gage track, mostly in the northern provinces. These narrow gage roads are managed entirely by Spaniards, but, although prosperous, their gross earnings amount to only 5 per cent. of the total for all the roads in the country. Since the standard gage on other European roads is 4 ft. 8½ in., all freight and passengers coming from any part of Europe have to be transshipped at the Spanish frontier. With the exception of a few miles all Spanish railroads are single track. Most of the trunk lines need a double track and a considerable increase in the service and in the rolling stock and locomotives. The total rolling stock is: 1,890 locomotives, with a total of 849,280 horse-power; 5,548 passenger cars; 15,700 freight cars (covered), and 20,483 freight cars (open trucks).

The total amount of gross earnings is about $57,000,000, out of which $54,000,000 is earned by normal-gage systems, and $3,000,000 by narrow-gage systems. The operating expenses amount to about $26,000,000, 48 per cent. of the gross earnings. The number of passengers transported is about 37,500,000, or 4,800 per mile. The total freight amounts to about 20,000,000 tons, about 2,560 tons per mile. Gross earnings have increased about 50 per cent. in the last 10 years. The rates of passengers' fares vary from 1½ cents to 4¾ cents per mile, according to each of the three existing classes of cars. Freight rates vary from 2¾ cents to 10¾ cents per mile, according to tariff rates on each of the six existing classes of goods.

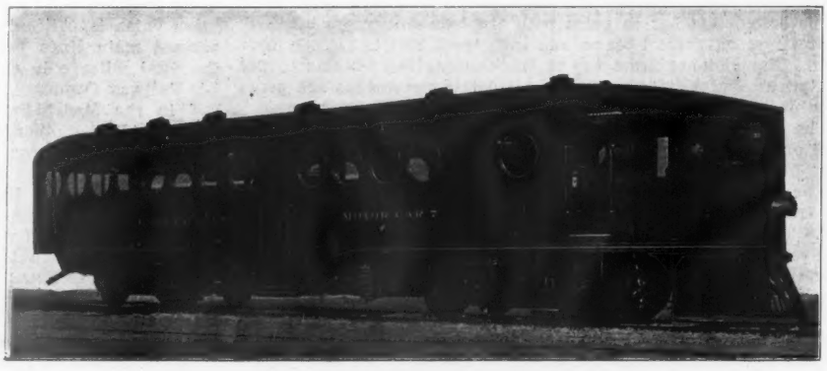
The operating expenses in Spain are lower than those in England and France. The Madrid-Saragossa Company has an operating ratio as low as 40 per cent., and, as a rule, all the other systems should be worked at the same rate. Materials also, such as ties, timber for buildings, wagons, etc., are cheap. Labor is considerably cheaper than in almost any other European country. Though some improvements have been realized in the last few years, under the growing pressure of traffic in passengers and freight, they are still much below needs of the public which is constantly demanding better facilities, more rolling stock and quicker deliveries of goods. Some great improvements, such as the cheap kilometric passenger tickets, have shown that the Spaniards are ready to avail themselves of all facilities offered to them. The reduction of the present high freight rates would be equally advantageous to the companies and the public.

Among the various trunk lines whose construction has become a great necessity the most urgent is undoubtedly the direct trunk line from Madrid to Burgos and to the French frontier, which shortens the present circuitous route from the Great Harbor, on the Bay of Biscay, Bilbao, and from France to the capital of Spain, by about 90 miles. This road, whose construction has begun, is to be of modern European gage, and will thus permit Spain to enter for the first time into through European railroad transport, avoiding the present trans-shipment of all merchandise and passengers crossing the Franco-Spanish frontiers. This road will be double track, thus assuring rapid traveling. According to a report of the United States consul at Bilbao, "this road will bring Bilbao within seven hours of the Spanish capital, a reduction of about 90 miles and a saving of eight hours as compared with the present time.—*Consular Report.*

Union Pacific Motor Car No. 7.

The Union Pacific has just turned out of the shops at Omaha its seventh gasolene motor car. As shown by the photograph reproduced herewith, the design has been much enlarged and considerably improved in general appearance, as well as in many details, since the first one was built last year. (*Railroad Gazette*, March 10, 1905). All of the cars since No. 1 have been much longer, with seating capacity for 57 passengers. No. 7 differs from those preceding it in the provision of a side door to facilitate receiving and discharging passengers, and in the form of the windows, which carry out still further the likeness to an inverted racing yacht, which was the model for the lines of the roof and forward end of the body.

Improved hill-climbing ability was sought in the present design and we understand good results in this respect were shown on trial trips. A speed of 40 miles an hour was easily developed and vibration and noise from the engine were little noticeable.



Union Pacific Motor Car, No. 7.

Reply of Coal Operators to Miners' Committee.

TO MR. JOHN MITCHELL, AND OTHERS, COMMITTEE OF ANTHRACITE MINE WORKERS.

Gentlemen.—In 1902 you assented to the proposition of the operators that "all questions at issue between the respective companies and their own employees, whether they belong to a union or not," should be decided by the Anthracite Coal Strike Commission; accordingly the award of the commission covered and decided all such questions; therefore, we have heretofore proposed to you that the relations thus established by arbitration be continued for a term of three years—the same period as that fixed by the Strike Commission. This offer you have rejected.

Your present proposition is that all relations between every employer and his employees shall be fixed and controlled by a single instrument. Originally you suggested that this should be a form of contract with the "United Mine Workers of America"; now you suggest that it shall be with your committee as "representatives of the anthracite mine workers." Inasmuch as the authority and standing of your committee as representing anyone depend wholly upon its designation by a convention of the United Mine Workers as the representatives of that body, it is clear that the change proposed is not substantial, but merely formal, and raises no new question. This is evident also from the fact that your proposition contains numerous provisions for action by "the organization" and "the district officers" of the United Mine Workers of America.

This proposition restricts production by strictly limiting hours of labor and providing that no miner can work in more than one chamber or have more than two laborers; it seeks to equalize wages with reference merely to the name of the employee's position, and not at all to his capacity or the work which he actually does; provides that no new veins or collieries can be opened without an arbitration as to wages, and that no contract of employment can be terminated without an arbitration; it makes the employers the agents of the union to aid it in levying upon the wages of the employees the dues fixed by the union; it provides for increase in wages and rates of payment which would approximate 21.6 per cent., and would increase the cost of the domestic sizes of coal about $1.20 per ton, and it suggests diluting the present Conciliation Board into three boards having co-ordinate powers. It provides still further that the arrangement proposed shall continue in force merely for one year.

The above provisions, other than those regarding wages, and the adjustment of complaints, concern radical and fundamental principles in reference to the management of the business which are vital to its success. These questions have all been settled by the award of the Strike Commission, which has established the existing conditions.

So far as concerns the matter of wages and adjustment of complaints, we have offered to submit to the members of the Strike Commission the question whether any changes in conditions have occurred since the award of the Commission requiring that the award should be modified as to those matters and, if so, how it should be changed. Those are the only subjects in regard to which you have made the least suggestion that the conditions have changed since the award of the Commission, and as to those no facts in support of that suggestion have been made public. But the claim for a change in the existing relations must obviously rest upon some change in conditions since those relations were all established by arbitration. You have rejected this proposition of arbitration. You now propose that it shall be submitted to the Strike Commission to decide whether the terms contained in your amended proposition, which are stated above, shall be adopted. In other words, you seek to have every subject which has been already settled by arbitration reconsidered, and every issue retried which was settled by the Strike Commission three years ago, pursuant to the President's injunction "to endeavor to establish the relations between the em-

ployers and the wage earners in the anthracite region on a just and permanent basis, and so far as possible to do away with any causes for the recurrence of such difficulties as these which you have been called upon to settle."

You say that "it is not a sufficient answer to say that because a question was arbitrated three years ago, the same question would not be a proper subject for investigation at this time." If any new facts have arisen in the meantime, these might properly be investigated. Nothing new is suggested to us by your communications. But it can scarcely be seriously claimed that questions already fully considered shall be re-examined because one of the parties thinks it may upon a rehearing secure a different decision. If that were so, controversy would never end. Indeed, in the present case you propose that in order to make an arrangement for only one year's duration, the Strike Commission shall re-examine questions which it took six months to decide.

To resume, the fundamental principles regarding the conduct of this business have all been established by the Strike Commission. No reason is suggested why they should be retried. As to the only matters regarding which you have made the least suggestion that conditions have changed, we have suggested that the existence and effect of such change be considered by the Strike Commission, and that its award be in force for three years so that political considerations may have as little influence as possible upon these business questions.

You are responsible for the suspension of work. There was no good reason for ordering the men to stop work pending our negotiations, which had been delayed by you, especially in view of the fact that we were willing to continue to pay the wages fixed by the Strike Commission.

We have no other suggestions to make than those contained in our former propositions, and we regret that you have declined both of them. We have nothing further to offer.

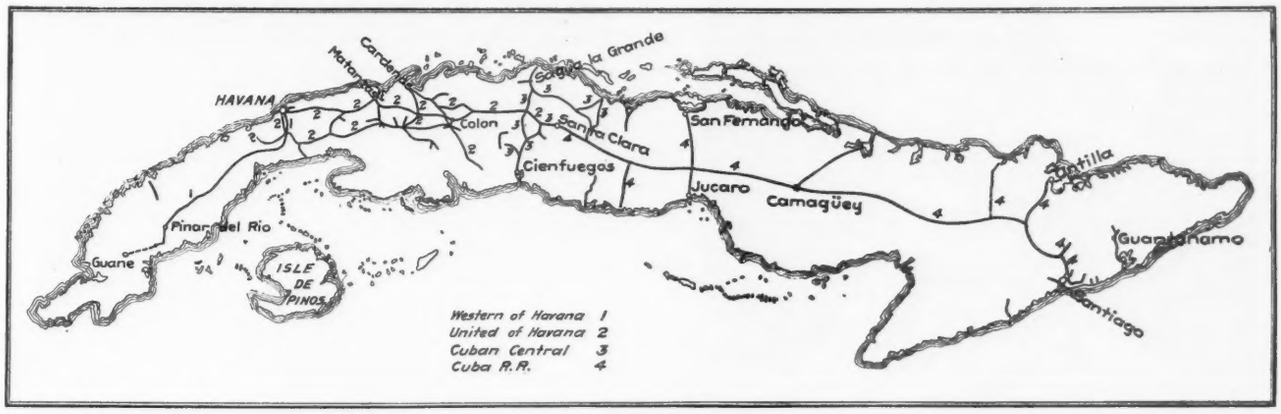
Yours respectfully,

GEORGE F. BAER, E. B. THOMAS, DAVID WILLCOX, W. H. TRUESDALE, MORRIS WILLIAMS, JOSEPH L. CAKE, JOHN B. KERR, Committee.

The Railroads of Cuba.

The railroad system of Cuba consists of a single trunk line from Havana to Santiago, supplemented by a number of transverse sea-to-sea roads which, in the western part of the island, have been developed into interlacing local systems. This situation, however, is not the result of the building of the trunk line first and then constructing feeders; the history of the railroad development of the island shows that the exact opposite was the case. The first roads were built by plantation owners to connect them with the nearest seaport. As Cuba is a narrow island and has for some centuries been active in foreign commerce, there was always some port within a comparatively short distance of the plantation, so a number of short and disconnected lines were built. It was not until the last decade of the nineteenth century that the amalgamation of groups of these odds and ends of road into anything like important railroad systems began. Most of the railroads in the western half of Cuba were, between 1892 and 1899, acquired by three companies, controlled by English capital.

The first of these companies to be incorporated was the Western Railway of Havana in 1892. This road runs southwest from Havana through Pinar del Rio to San Juan, 125 miles, over rolling country south of the Sierra de los Organos Mountains.



Cuban Railroads.

Palm Avenue near Guanajay—United of Havana.

Old Spanish Bridge—United of Havana.

The track is standard gage and construction was started in 1857, the first 10 miles being opened for traffic in 1861. This part of Cuba was the scene of some of the hardest fighting in the last rebellion against Spain before the war of 1898, and the railroad suffered heavily during that period. Trains were attacked and dynamited and much of the roadbed destroyed. Stations and several whole towns were burned, but have now been restored and the road is in much better condition than before the uprising. The traffic is mostly sugar and tobacco, but the land is fertile and abundantly watered and is suitable for cattle raising and most tropical fruits and vegetables. It is interesting to note that in this district an excellent quality of Sea Island cotton can be grown. On account of the absence of frost it is unnecessary to replant each year, and it is probable that the Cuban production of this staple will compete with the United States grown cotton.

The United Railways of Havana was incorporated in 1898 and, aside from its railroad property, owns land, warehouses, and does a banking business. The system consists of about 463 miles of line lying mostly in the Provinces of Havana and Matanzas, 210 miles

San Cristobal River—Western of Havana.

Near the Main Line to Matanzas—United of Havana.

Falls of the Taco Taco—Western of Havana.

of which represents the Cardenas & Jucaro, which was taken over a few months ago. The first section of the lines now operated by this company was opened for traffic in 1837. The part of its road which runs eastward from Havana through Matanzas and Jovellanos to Esperanza, in the Province of Santa Clara, constitutes the first link of the through line from Havana and Santiago. Another important road goes from Havana to Batabano directly south of Havana on the south coast, and there are other branches and connecting lines between these roads. The country served is comparatively flat and is rich and fertile. In the western part of the Province of Havana there is an important tobacco raising district, which is reached by the lines of this company, while the center and southwest portion is particularly suited to the raising of sugar cane as

Falls of the Hanabanilla—United of Havana.

well as tobacco. The bulk of the freight traffic is sugar, either in the cane or partly refined. This is shipped from Havana to New Orleans and other ports in the United States. The traffic in fruit and vegetables is rapidly growing in importance, truck farming being carried on on a large scale especially around Guines, about 45 miles south of Havana. This produce gets a ready market in the United States, the low rates prevailing by steamer from Havana favoring export to this country.

The Cuban Central was incorporated in 1899 to take over the Cienfuegos & Villa Clara, the Sagua La Grand and the United Caibarien Railways, a total of about 217 miles. One of the roads runs from Sagua La Grande across the island to Cienfuegos, and another runs from Caibarien westward to a connection with the first line. There are also several branches and cut-offs and one road from Esperanza to Santa Clara makes a link in the trunk line by connecting at the last named town with the Cuba Railroad.

The western part of Cuba is much more thickly populated than the eastern part. It can be compared in railroad development to the Atlantic states of this country. There is little, if any, new country to be opened up by a railroad and branches or extensions are built only to existing towns to take care of the traffic in sight, rather than to create traffic by running a line through unsettled regions. The Western of Havana is building an extension from its western terminus to Guane, and the United of Havana is building 20 miles of road from points on the old Cardenas & Jucaro.

United of Havana.

The eastern part of the island, consisting of the provinces of Puerto Principe and Santiago de Cuba, was, until a few years ago, without railroads of any importance, there being a few short lines built from seaports a few miles into the interior. There was only one line dunning across the island, this being the Jucaro and San Fernando, which was built by the Spanish Government for military purposes. This is now leased by the Cuba Railroad.

The Cuba Rail- starting from Santa Clara on the Cuban Central, completes the trunk line to Santiago. Its mileage, including leased lines and branches, is about 500. It was built by Sir William Van Horne, Chairman of the Board of the Canadian Pacific. The company was incorporated in 1900, and the line through to Santiago was opened in December, 1902. It got its entrance into Santiago by buying the Savinalla & Marota, which ran from San Luis to Santiago, 30 miles, taking the only practicable route to the coast through the Sierra Maestra mountains. A large part of the Cuba Railroad was built through virgin forest, and many new towns have sprung up along it. A branch has been completed from Alto Cedro, on the main line, northeast to Antilla on the Bay of Nipe. This "branch" will eventually be the eastern part of the main line, as it is plannedto make Antilla the seaport for all the exports which are now shipped from Santiago. The Bay of Nipe is a perfectly protected harbor 20 miles

Bottle Palms, Herradura—Western of Havana.

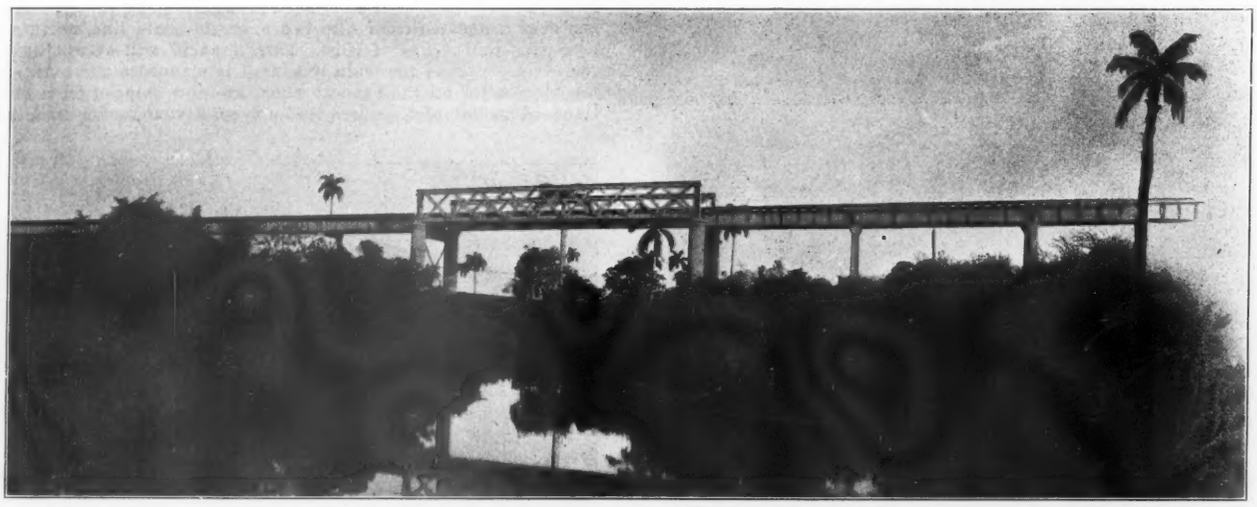
Orchids—Western of Havana.

long and is nearer New York than Havana is. Extensive terminals are being built and ships drawing 18 ft. will be able to come up to the docks. Work is also under way onabranch from Cacocum north to Holguin, 15 miles, to connect with the Gibara & Holguin, Gibara being a port on the north coast. The principal traffic of the Cuba Railroad is in sugar, mahogany and other timber.

The four companies mentioned operate between 1,200 and 1,300

Typical Scenery—United of Havana.

miles of the total 1,600 miles of road in the country. Nearly all is standard gage. The Matanzas is the longest of the smaller independent railroads; it runs from Matanzas south to the center of the island and then east to Colon, on the United of Havana. It is about 200 miles long, including branches. The Guantanamo runs north from Caimanera through Guantanamo to Soledad, 35 miles,



Long Steel Girder Trestle—Western of Havana.

and is building 40 miles more. The Cuba Eastern runs from Boqueron on the Bay of Guantanamo, northwest to San Pre, and is planning an extension to San Luis on the Cuba Railroad. This will develop a sugar district now without transportation facilities.

We are indebted to the United of Havana and the Western of Havana for their courtesy in supplying information and the accompanying illustrations.

Electric Traction for Trunk Lines.

The following extracts are from a report made by Mr. K. de Kando, Chief Engineer and Electrical Director of Ganz & Co., to his company on impressions received by him on his recent trip to America.

The development of electric traction on trunk lines has an entirely different history in Europe and in America.

In America the first electrification of trunk lines was forced through the competition of street railways which prolonged their lines outside of the city limits (as early as 1897 the New York, New Haven & Hartford R. R. electrified its Nantasket Beach branch). This electrification on trunk lines was in the nature of things a mere copy of street railway operation on a larger scale.

Just as have been all American developments, this was a rapid one. The advantage which electrification showed over steam service was so attractive as to lead not only to electrification of such steam lines as were suffering through competition of electric street railways, but several new lines were built, more particularly for suburban traffic, where heavy trains composed of numerous cars were operating similar to service on electric trunk lines. (Chicago, Aurora & Elgin, etc.)

It is only natural that in this rapid development experiments with new systems could find no place, all the more so since the continuous current system itself had to pass through experimental stages of several years duration until it reached the present point of perfection. Purchasers as well as manufacturers were therefore afraid to try new systems when they were exposed to a repetition of the bitter experience which had marked the first years of continuous current operation.

Nevertheless both the General Electric company and the Westinghouse Electric & Manufacturing company made tests with polyphase and single-phase motors ten years ago, as is shown by the patents of that time (Steinmetz and Armstrong). These experiments proved to be failures, partly because the development of the induction motor was at that time not advanced enough to fulfil the requirements of electric traction, and partly because the attempt was made to operate the new system simply by replacing the continuous current motor by a polyphase motor and the series connection by cascade connection. The polyphase motor used in this manner was not a very good substitute for the continuous current motor. The really valuable features of the polyphase motor, its use of high tension, etc., were not made profitable. In addition, the mistake was made of exaggerating the importance of the air gap between rotor and stator which, following continuous current street railway practice, was taken several times larger than the air gap which is possible with polyphase motors through the use of correct design of the bearings.

The failures of these experiments on polyphase motors and the scientific arguments against this motor in the publication of Berg produced a public opinion among American engineers which was against the three-phase motor as a railway motor. (Berg's calculations were based on three-phase motors with much larger air gaps than is possible in good practice and the result was that the comparison between continuous current and three-phase motors was unfavorable to the latter.) It was therefore natural that the single-phase commutator motor was preferred as a substitute for the continuous current motor. I had no occasion to see the single-phase motor of the General Electric Co. in operation, and I made no special attempt inasmuch as public utterances of General Electric Company's

engineers showed that they do not consider the question of single-phase traction as important as do the engineers of the Westinghouse Electric & Mfg. Co., which has placed upon the market a series of single-phase motors. I have seen in operation the largest of these motors and also some of the small ones, and as far as a cursory inspection permits drawing decisive conclusions these motors appeared to be equal to the best continuous current motors in regard to working of commutators and brushes.

The Westinghouse single-phase system is the best developed among the single-phase systems known to me, and as far as I know, Mr. Westinghouse is thus far the only one who has built large single-phase locomotives.

In order to judge of the chances of the three-phase system for future work, it is necessary first of all to make a comparison with the single-phase system. We will not be wrong in using the results obtained by the Westinghouse company with its single-phase motors as a basis of comparison inasmuch as these motors are probably those which have been most perfected. The details will be mentioned later.

As regards the development of electric traction for trunk lines, in Europe this problem was presented in an entirely different form than in America. There were really two problems. The first was the one taken up by the German "Investigating Committee" appointed to look into the question of high-speed electric traction. The results of the Zossen experiments carried out by this committee will be a valuable inheritance for the future.

The second problem was that which was placed before Ganz & Co. by the Societa per le Strade Ferrate Meridionali in 1897. Inasmuch as Italy has no coal, but has large unused waterpowers in the neighborhood of the railroads, and since these roads pay to-day many millions of lire for English coal, the Italian Government requested the two largest Italian railroad companies, the Societa Meridionale and the Societa Mediterranea, to carry out experiments which would lead to the use of electric power for their lines.

The Societa Mediterranea chose as a trial line their line from Varese to Milan, which line is almost in its entire length without curves and without gradients and which has a dense traffic. The equipment of this line was intrusted to the British Thomson-Houston Company, which installed a plant according to the well-known American continuous current system. The result was an increase of passenger traffic, as might have been expected judging from American examples of development in suburban systems, and this increase in traffic sufficed to cover the considerable increase in operating expenses. The electrification of this line was therefore a success in technical as well as commercial respects.

The Varese-Milan line was, however, not a solution of the given problem. The only problem solved was that of handling dense suburban traffic, but not the substitution of steam locomotives throughout the entire network of a trunk line. It is necessary to say that on this Varese-Milan line all freight trains and also all through passenger trains are handled as heretofore by steam locomotives.

The Societa per le Strade Ferrate Meridionali laid the problem before Ganz & Co. in its entire extent and demanded a proposition whereby all steam locomotives on the Valtellina line could be replaced by the energy of the Adda River.

The well-known continuous current system with 500 to 600 volts appeared inadvisable on account of the long distances, the size of train units, the gradients and the resulting large capacity of the locomotives and the comparatively sparse traffic which would have made a continuous current installation very expensive. A new system had therefore to be found which was low in first cost of installation and efficient even over long distances and with heavy train units, and the new system had to produce a locomotive which in its capacity was superior to the present day steam locomotive, since the designers of the latter were making every possible exertion to increase the power per weight unit, and the electric locomotive had therefore to improve on this ratio.

To solve the problem, a high pressure for the contact line had to be chosen and the motor had to be built for this high pressure in order to avoid the carrying of a transformer on the locomotive. This condition is only fulfilled by the induction motor or by the repulsion motor. Of the two types the polyphase induction motor is superior in efficiency as well as in power per weight unit, and it was therefore chosen for the Valtellina line.

Shortly afterward the German "Investigating Committee" chose the polyphase system for its experiments at Zossen, which in a way confirmed the correctness of choice of system in the Valtellina line. After the Zossen experiments had produced the desired results as regards speed, and after they were concluded we find, however, that German opinion changed somewhat and began to favor the single-phase system. It almost appears as though engineers thought that the polyphase system had not been proved a success in Zossen. Should this actually have been the case, I could account for it principally by the two following reasons:

First: The arrangement of three contact wires in a vertical plane which made a real switch impossible and therefore the installation of this system in terminal yards impracticable.

Second: The use of a simple rheostat without other regulating devices, such as cascade connection or different number of poles made necessary an excessive amount of energy wasted at the start, an amount equal to the energy used by the train running at full speed.

It would have been advisable to use three or even four synchronous speeds to reach 200 Km. (about 120 miles) per hour. Thus the rheostat losses could have been reduced to one-third or one-fourth, and at the same time the maximum peak could have been reduced to one-half through correct choice of acceleration at the various starting points, even without increase in time of run.

During the last few years almost every large electrical concern has studied the design of a suitable single-phase traction motor. The best work in Europe in this line is shown in the Winter-Eichberg motor. This motor is not as perfect, as far as commutation is concerned, as the Westinghouse motor, but it is not as delicate, inasmuch as it can (according to the statement of Dr. Eichberg) be short circuited during 30 seconds, giving the full torque standing still without burning out the short circuited armature coil. The largest motor which I saw in Berlin was a 115 h.p. motor built for the Hamburg-Altona Ry. The data which was given me in Berlin will be discussed further on.

The problem of electrification of the Italian roads was similar to the problem placed before the Swiss roads and also before the Swedish and Norwegian roads, with the difference that the two latter used trains of much less weight and used lower speeds and therefore required locomotives of less capacity than were used by the Swiss and Italian roads.

In Northern Germany the electrification of trunk lines is not yet of actual importance, but in Southern Germany, as well as in Austria and France the electrification of the mountain railroads may be expected in a comparatively short time.

In the United States the electrification of railroads in the shape in which this problem presented itself in Italy has never yet been discussed. But if we consider the enormous exertion made by American railroads to increase the capacity of their lines, it is certain that electric traction will play an important role in this endeavor to obtain greater capacity and that that electric system will prove to be victorious, which can present the most powerful locomotive and the locomotive which will possess the greatest capacity for a given weight.

First of all are to be considered the pusher locomotives which are used on long grades that could only be reduced by enormous expenditures. In all these cases the three-phase locomotive has a tremendous advantage on account of its great capacity per weight unit and furthermore on account of the possibility of recuperating energy on down grades.

I have had occasion to go over the Susquehanna-Deposit grade of the Erie Railroad several times and to watch the traffic on this line. I have seen a freight train composed of 62 cars weighing together 4,923,000 lbs. handled by five locomotives, one in front and four as pushers in the rear. The weight of each locomotive with its tender was 144 American tons, and the weight of the five locomotives is 655 metric tons, making the total weight of the train 2,395 metric tons. The operating engineer of the railroad told me that similar trains were generally handled with three pushers and that the train above, which I saw, was really a special one inasmuch as the fourth locomotive made its first trip and was only to be tried out on this occasion.

The importance of electric traction for such a line is given first of all by the increase of capacity on account of the more powerful electric locomotives and then by the economy in operating expenses.

As regards the first point, the increase of capacity per weight unit, it may be interesting to note the following data:

The above mentioned line has a total length of 15.3 miles, and the annual traffic is about 170,000,000 gross ton miles. In order to handle the entire pusher service by electric locomotives it would be necessary to invest $600,000 in power stations, line equipment, sub-stations and locomotives. As a basis of calculation we take the above mentioned train using three locomotives only, instead of four, with a total weight for the three of 3 x 131 = 393 metric tons, which is 17.5 per cent. of the gross tons. If we add to this about one-third for locomotives returning empty, the number of yearly ton miles which correspond to the weight of the pusher locomotives, is equal to 40,000,000 ton miles.

Using three-phase locomotives, Ganz system, the three steam locomotives could be replaced by two electric locomotives each weighing 60 tons, with all the weight on drivers. The steam locomotives at the head of the train can haul on this grade 650 American or 590 metric tons and the pushers have therefore to haul 1,650 tons which corresponds to a drawbar pull of about 25,000 Kgr. (about 55,000 lbs.). This would reduce the number of ton miles to 12.2 million ton miles per year, or, in other words, in the case of electric traction there would be a saving of 27.8 million ton miles merely on account of the lesser weight of the electric pusher locomotives.

This figure speaks for itself, and it is not necessary to point

out how important it is to have the smallest possible weight for a given capacity and how necessary it is to use the weight of adhesion to the fullest extent in all such heavy traction problems.

As regards the savings which can be effected through the use of the three-phase traction system, a few figures are given below merely for the purpose of showing the approximate extent to which such savings may be expected.

Electric traction will allow savings to be made in the cost of coal, in the cost of train hands, in the cost of repairs to locomotives, in the expense of providing for water, and if three-phase traction is used with recuperation, in the omission of a great part of the mechanical braking and in the small cost of wheel tires and brake shoes. In the following I shall only deal with the first three savings which are in most cases of greatest importance.

Electricity as motive power will permit a great saving in coal. As shown by European railroad statistics, 0.08 to 0.1 Kgr. of coal is burned for each gross ton Km. as an average (about 0.25 to 0.30 lbs. per ton mile). On the lines such as the above mentioned, with heavy grades, the coal consumption will be greater and will certainly not be overestimated by taking 0.16 Kg. (0.35 lbs.) per ton mile. If the work done by the pusher in the above instance is taken on an average, at three-fourths of that done by all locomotives, then the coal consumption of the pusher locomotive will be equal to three-fourths of the coal consumption, or: $\frac{3}{4} \times 170{,}000{,}000 \times 0.35 = 44{,}600{,}000$ lbs. $= 22{,}300$ tons. If we take the price of coal at $2.85 per ton the total cost of coal for one year will be $63,600. As against this, the cost of production of electric energy will be considerably less. In the case of three-phase current, the consumption in one year will be about 4.25 million Kw. hours. If we take the cost of one Kw. hour at the switchboard on the average, including all expenses, at 1c. (the cost at the New York Subway power house is 0.8c.), then the cost of electric energy in one year will be $42,500, or $21,100 less than the cost of coal for steam locomotives, which represents therefore a saving equal to 3.5 per cent. of the first cost of installation.

Further savings will be made in the wages to train hands inasmuch as cleaning of fires and steaming up of locomotives are entirely absent. This saving can be estimated at $30,000 to $35,000 which corresponds to about 5 to 6 per cent. of the first cost of installation.

A further saving is possible through the reduction of cost of repairs. Experience has shown that the cost of repairs on large electric locomotives such as those used on the Valtellina line or the New York Central can be taken at about 1.7c per locomotive mile. The cost of repairs of steam locomotives is about 5c. per locomotive mile (the pusher locomotive will work as a rule at full capacity of their boiler and engine and the depreciation will therefore undoubtedly be higher than with the ordinary locomotives). If therefore the total locomotive mileage is taken at about 370,000 miles the cost of repairs of steam locomotives will be at least $18,500. In the case of electric pushers where the number of locomotive miles will be only two-thirds of 370,000 (instead of three steam pushers only two electric pushers will be necessary), the cost of repairs for 250,000 locomotive miles will be about $4,270. This represents a saving of $14,270 per year, equal to about 2.3 per cent. of the first cost of installation.

In order to judge the value of the recuperation feature, I submit the following approximate data: The pusher service on the above line requires, without recuperation, about 5,000,000 k.w. hours per year. The total number of k.w. hours which could be recuperated works out to be about 1,500,000 k.w. hours at the switchboard of the power house. Provided the electrification of other lines or the sale of electric energy to other consumers would always provide a useful load for this recuperated energy, these 1,500,000 k.w. hours could be counted in full, taking the cost of energy at 1c. per k.w. hour and assuming that about 0.5c. of this corresponds to that part of the cost per k.w. hour which is proportional to the output of recuperated energy. This effects a saving of $7,500 per year, which corresponds to about 1.2 per cent. of the first cost of installation. Even if no other consumers can be found it has been shown through detailed calculations made in similar instances that the trains running up the grade and the general loss of the system will make use of at least about 50 per cent. of the recuperated energy, and it will be seen therefore that the recuperation will contribute at least 0.6 per cent. to the general charges against the first cost of installation.

The total amount saved in operating expenses will in all events correspond to more than 10 per cent. of the total cost of the electric plant.

If we consider that in America locomotives are put out of service and replaced by new ones in much shorter time than in Europe, and that therefore the steam locomotives which would be replaced by electric locomotives may be used immediately on other lines, it will become evident that we are justified in taking as first cost of installation for the electric traction only the difference between the entire cost of the electric equipment and the value of the replaced steam locomotives. This will increase the percentage of interest paid by the saving, and it can be asserted with absolute security that the three-phase system can count on a great future, not only in Europe but also in America.

(To be continued.)

Cast Steel Cylinders.

The motive power department of the New York Central Lines has been making investigations and done some preliminary work in the way of ascertaining the possibility of obtaining steel cylinders for heavy locomotives. Thus far no attempt has been made to design a cylinder with the special object of having it cast from steel. The question to be solved in the first place was whether so large, heavy and complicated a casting could be made of steel.

The Penn Steel Casting & Machine Co., of Chester, Pa., which agreed to undertake the work, was furnished with the patterns of the ordinary cast iron cylinder, having a diameter of 23 in. and a piston stroke of 32 in. No change whatever was made, and the work was successfully done on the first pair. These weighed 7,810 lbs. The result was so satisfactory and the castings were apparently so sound that a second pair was ordered from the same pattern after a few changes had been made by which the weight was slightly reduced. This consisted in merely cutting off the strengthening ribs that encircle the shell and thinning the central rib by

Cast Steel Cylinder for New York Central Locomotives.

which the two cylinders are bolted together. Nothing was done that could not be done easily and cheaply without mutilating or seriously altering the pattern, and no change at all was made in the core boxes. The cylinders are, therefore, in every sense experimental—mere reproductions of the cast iron, and not what would have been designed for steel; the idea having been to ascertain whether a steel cylinder could be made at all, and, if so, whether it would be feasible commercially. The second pair of cylinders weighed 7,740 lbs.

The tests of the metal of the two sets give an average tensile strength of 73,600 lbs. per square inch of section, an elastic limit of 34,500 lbs., elongation of 29 per cent., and a reduction of area of 39.55 per cent. with a silky fracture.

To those who are familiar with the difficulties of making large steel castings, especially of a design complicated by core work, as in the case of locomotive cylinders, the advance that has been made and the skill required to produce these cylinders will be most evident. The solution of the problem will place this stronger metal at the disposal of designers who will now be able to reduce the weight of these heavy front castings, that usually add little or nothing to the adhesive weight of the engine, by a considerable amount.

The cylinders will, of course, be bushed with cast iron and used on freight engines. The results that they give in service will be watched with great interest, for it will be upon this that an extension of their use will depend.

GENERAL NEWS SECTION

NOTES.

The Central Vermont has made a slight increase in the pay of 600 trainmen.

A freight agent at Fort Worth, Tex., has been indicted by a Grand Jury for compelling his subordinates to work on Sunday.

F. E. Behr, the monorail man, has asked the Rapid Transit Commission of New York City to consider a plan which he has in mind to establish a monorail between Brooklyn and Coney Island.

A demurrage bill of $2,500 accrued at Dunkirk, N. Y., recently; 80 carloads of stripped locomotives loaded there to go to the coast for shipment to the Isthmus of Panama were held a month for want of shipping directions.

A disagreement concerning wages between the Grand Trunk Railway and its locomotive engineers has been referred to a board of three arbitrators: Wallace Nesbitt, of Toronto; P. H. Morrissey, of Cleveland, and John F. Wallace, of Chicago.

The Railroad Commissioners of Texas propose to order all passenger fares in the state reduced to 2½ cents a mile, and will give a hearing on May 5, when the railroads can offer any objections which they may have. The rates at present are 3 cents a mile.

The Southern Railway, the Alabama Great Southern, the Alabama & Vicksburg, and the Vicksburg, Shreveport & Pacific, announce that a through train is to be run daily each way between Atlanta, Ga., and Shreveport, La., by way of Birmingham and Meridian. Existing trains will be connected and quickened.

The Wabash lines east of Toledo and the Baltimore & Ohio are reported to be in need of telegraph operators.

The upward inclination is looking up. Semaphore signals of this type, the Loree-Patenall patent, the arm to be moved upward from the horizontal to indicate proceed, are being installed on the River division (West Shore) of the New York Central & Hudson River road between West Cornwall, N. Y., and Newburg, a distance of five miles. These signals are a part of the extensive installation or normal-danger block signals being put in on the West Shore by the Hall Signal Company, and will be the first of the kind in the country to go into regular service.

The Boston & Maine has lately put in use the new automatic block signals between East Somerville, Mass., and North Beverly, which have been under construction for several months back. In these signals green is used for the night proceed indication, yellow in the distant signals when the arm is horizontal, and blue for the night stop indication in dwarf signals.

Reporting on a collision at Black Rock, near Buffalo, Feb. 26, the New York State Railroad Commission has recommended that the line of the New York Central at that point be equipped with a block signal system. The superintendent of the road has notified the commission that the recommendation will be complied with.

The opening of the Wind river or Shoshone Reservation public lands in Wyoming has been postponed until August 15, 1906, by joint resolution of Congress. Construction of the Chicago & North-Western's line to the Reservation border is being pushed rapidly and will probably be finished within a few weeks.

President Mellen, of the New York, New Haven & Hartford, has notified a committee of citizens of Lyme, Conn., that the railroad company will present to the State of Connecticut, as a gift, the bridge across the Connecticut river at that town, on the completion of the new bridge which is now being built. The citizens want the old structure for a highway bridge. Mr. Mellen makes the proviso that if a trolley track is laid on the bridge it shall be used only by a company controlled by the New Haven.

The Louisville & Nashville, having reduced its passenger fares on a part of its line near Louisville to half the ordinary rates, to compete with an electric line, will be called before the State Railroad Commission to defend its action, complaint having been filed with the Commission that in making this reduction the L. & N. discriminates against the general public. The low rates apply only on certain new trains, running once an hour, which were put on specially to compete with the electric line.

The City of Chicago has won its suit in the Supreme Court of the United States to compel the removal or lowering of the street railway tunnel under the Chicago river at Van Buren street. The railway company contended that as the tunnel, when made, was a lawful structure, neither the state nor the city had power to compel its removal without compensation; but the Supreme Court decides that the order made by the city is a proper exercise of governmental authority in the interest of the common welfare. The opinion was by Justice Harlan.

The State Railroad Commissioner of Michigan has ordered the Michigan Central to reduce passenger fares on three lines where the passenger receipts have increased since the rate of fare was fixed under the law two or three years ago. On the line between Detroit and Bay City and that between Jackson and Bay City the reduction must be from 3 cents to 2.5 cents a mile, and on the line from Jackson to Grand Rapids the rate must be made 2 cents. On the last-named line the passenger earnings last year were $3,500 a mile, an increase of 75 per cent. since the former reduction from 3 cents to 2.5 cents.

The latest employee of the Baltimore & Ohio Railroad to be retired on a pension is Mrs. Mary L. Bounds, a car cleaner at Wheeling, W. Va. Mrs. Bounds began work Oct. 2, 1868, in the yard at Wheeling, and there she has remained. She has never made a single trip for pleasure and her only travel on the railroad was five trips to Weston, a distance of 109 miles from Wheeling, which she made to visit her invalid husband. She wants everybody to know that during her entire service with the railroad she has received the very best of treatment from her employers, and she is profuse in her praise of General Superintendent W. C. Loree and Division Superintendent A. W. Thompson. For the last five years she has received $30 a month; before that $25, except in hard times, when she was cut down to $23.

Floods in California and Nevada.

A recent blockade caused by landslides on the Valley division of the Southern Pacific, at the mouth of Tunnel No. 17 in the Tehachapi Range, about eight miles north of Bakersfield, Cal., blocked the road for eight days. It was finally raised by building a bulkhead of heavy timbers after removing a portion of the accumulated earth. As fast as a steam shovel made a hole in the pile of dirt, this timber retaining wall was extended, putting a stop to the slides, which had been occurring frequently for several days. Above the barrier, which somewhat resembles the frame of a snowshed, lie thousands of yards of loose earth, which are by this means kept from covering the tracks. The San Pedro, Los Angeles & Salt Lake has completed its reconstruction work where the tracks were washed out by the recent floods sufficiently to resume through passenger and freight trains. A force of 2,000 men has been at work, the largest gang being at a big washout near Caliente. Construction crews from the Tonopah and Las Vegas line were brought in to assist in clearing the line. Through travel was suspended over three weeks.

Grossly Unreasonable.

The latest decision issued by the Interstate Commerce Commission declares that a certain rate made by the Missouri Pacific on flour in Arkansas—42 cents per 100 lbs.—is grossly unreasonable, and that the reasonable rate for the service would be 11 cents per 100 lbs. The complainant was Moran, of Lamar, Mo., who shipped two cars of flour to Hope, Ark. The 42-cent charge was from Little Rock to Hope, the flour having been sent to Little Rock over the St. Louis & San Francisco. If it had been sent all the way by the Missouri Pacific it would have gone through for 25 cents per 100 lbs. (with the addition of $3 for switching to the Missouri Pacific tracks at Lamar). The distance from Little Rock to Hope is 112 miles, and the rate which is declared reasonable (11 cents) is that prescribed in the tariff of the Arkansas State Railroad Commission between those points. From Lamar to Little Rock the rate by both of the competing roads is 20 cents. The Missouri Pacific offered the shipper a rebate to 24 cents; and then a second reduction (to 19 cents instead of 24), but both were declined by the complainant.

Extensive Water Works.

The Pennsylvania Railroad is to pump water over the Allegheny mountains from Wilmore to Altoona, 25 miles. An immense reservoir is being constructed at Wilmore, on the Pittsburg division, 92 miles from Pittsburg; a power station has been completed there, and pipe lines are now being laid to get the water to the reservoir and for pumping it over the mountains. This operation will be

one of the most important parts of the water supply scheme now being effected by the Pennsylvania on the main line between Pittsburg and Philadelphia. The establishment of an inexhaustible water supply was begun over a year ago, after the severe drought of the fall of 1904, and has been in progress since. The total cost of the system which the company has laid out is estimated at about $10,000,000.

A large number of charters on Cambria county streams were obtained last summer by underlying companies of the Pennsylvania. The American Pipe Manufacturing Company and the Mountain Water Supply Company are subsidiary concerns which are carrying out the Pennsylvania's plans, having been formed for that purpose. The scheme is one of the most extensive of its kind ever undertaken by a railroad company and will make the biggest system of pipe lines in use in the country.

At the big Wilmore reservoir, which is to have a capacity of about 40,000 gallons, the water secured from streams of several townships is to be centered, carried there by gravitation and by pumping. Five hundred carloads of pipe are now being shipped to Wilmore for the line, including the long stretch from Wilmore to Altoona. The pipe lines will extend as far west as Latrobe. Another reservoir will supply the Pitcairn shops from the Indian Creek watershed.

The pumping of water over the Alleghany mountains will be one of the greatest engineering feats in the history of the Pennsylvania. A power house 40 ft. x 86 ft., with a stack 120 ft. high, and of heavy equipment has been put under construction at Wilmore. From this station the water will be pumped 25 miles to supply the big car and locomotive shops of the Pennsylvania at Altoona. Contributing pipe lines to the Wilmore reservoir will be laid from Loretto and other points and a line has been finished from Beaverdale.

The Pitcairn shops will be supplied by a line from the Southwest branch, along which the Mountain Water Supply Company is now building dams and laying pipes. When the Pennsylvania's water system is finished (probably in 1907), an adequate supply for shops and locomotives will have been provided, even in the periods of most severe drought. Construction has been kept up all the winter and will be prosecuted more vigorously now that good weather is practically assured.—*Connellsville (Pa.) News.*

Inquiry as to Coal Traffic.

The Interstate Commerce Commission held an inquiry at Philadelphia last week in the investigation ordered by Congress to determine how far and in what manner railroads are interested in coal and oil which they transport as common carriers. The investigation, according to Philadelphia papers, established the fact that in three railroad statistical bureaus agreements exist governing the transportation and distribution of bituminous coal, and also fixing the percentage of coal to be carried by the different roads.

Testimony was brought out showing that these pooling agreements have been in operation for ten years, and that the Eastern New York and New England all-rail Bituminous Coal Traffic Association carries out an agreement that where agreed percentages are departed from, resulting differences shall be equalized either by diversion of traffic or suspension of shipping. Another bureau under the name of the Tidewater Bituminous Steam Coal Traffic Association governs all shipments to tidewater at New York, Philadelphia, Baltimore, Newport News and Norfolk. All bituminous coal shipped to New York harbor, except that going through all rail to New England, is regarded as tidewater coal, and commands a lower proportionate freight rate than when going to other ports, where only coal for points beyond the Capes gets the tidewater rate.

The testimony of officers of the Pennsylvania Railroad is summarized in the reports as showing that coal companies owning large numbers of cars have a decided advantage over shippers who have no cars, being able to contract for the delivery of coal at stated times; that railroad officers own stock in coal mining companies, and that it is often impossible to distribute the available supply of empty cars equitably. One statement is to the effect that the Pennsylvania refuses to run the private cars of shippers who own less than 500 cars.

Mr. White, statistician of the bureau of statistics of the Tidewater Bituminous Steam Coal Traffic Association, testified that the association was formed in 1896 and that it was subsequently agreed that the tidewater coal traffic should be apportioned among the roads in the association as follows: Pennsylvania, 46.65 per cent.; Beech Creek, 11.05 per cent.; Baltimore & Ohio, 11.35 per cent.; Chesapeake & Ohio, 12 per cent.; Norfolk & Western, 18.45 per cent. It appeared, however, that no settlements between the roads had been made since 1896.

It appeared that in 1902, when by reason of the anthracite coal strike, there was a great demand for cars in the bituminous coal trade, the Pennsylvania road sold 200 coal cars to the Berwin-White Coal Co.

Officers of the Pennsylvania Railroad having been asked to produce at a subsequent hearing certain books and papers from the company's offices, the counsel of the road the next day filed an appeal to the higher court against the granting of an order to compel the production of the books and papers.

At Baltimore testimony was taken concerning the relations of the Baltimore & Ohio with coal companies along the line of its road. A number of officers of the B. & O. own stock in coal companies.

Announcement was made by the Attorney-General at Washington last Tuesday that he had retained Messrs. Charles E. Hughes, of New York, and Alexander Simpson, Jr., of Philadelphia, to take under consideration all the facts now known, or which can be ascertained, relating to the transportation and sale of coal in interstate commerce; to advise what, if any, legal proceedings should be begun, and to conduct, under the direction of the Attorney-General such suits or prosecutions, if any, as may be warranted by the evidence in hand and forthcoming. Mr. Hughes was the counsel of the life insurance investigating committee in New York City last year.

This action by the Department of Justice is taken as a result of consideration of the subject by the Department for some time, and particularly in consequence of the evidence which has been taken by the Interstate Commerce Commission during the past two weeks, as noted above; and of the recent decision of the Supreme Court in Hale vs. Henkel, holding that the Federal government has the right under legal proceedings to examine the books and records of corporations engaged in interstate commerce.

London Tube Railways Permanent Way.

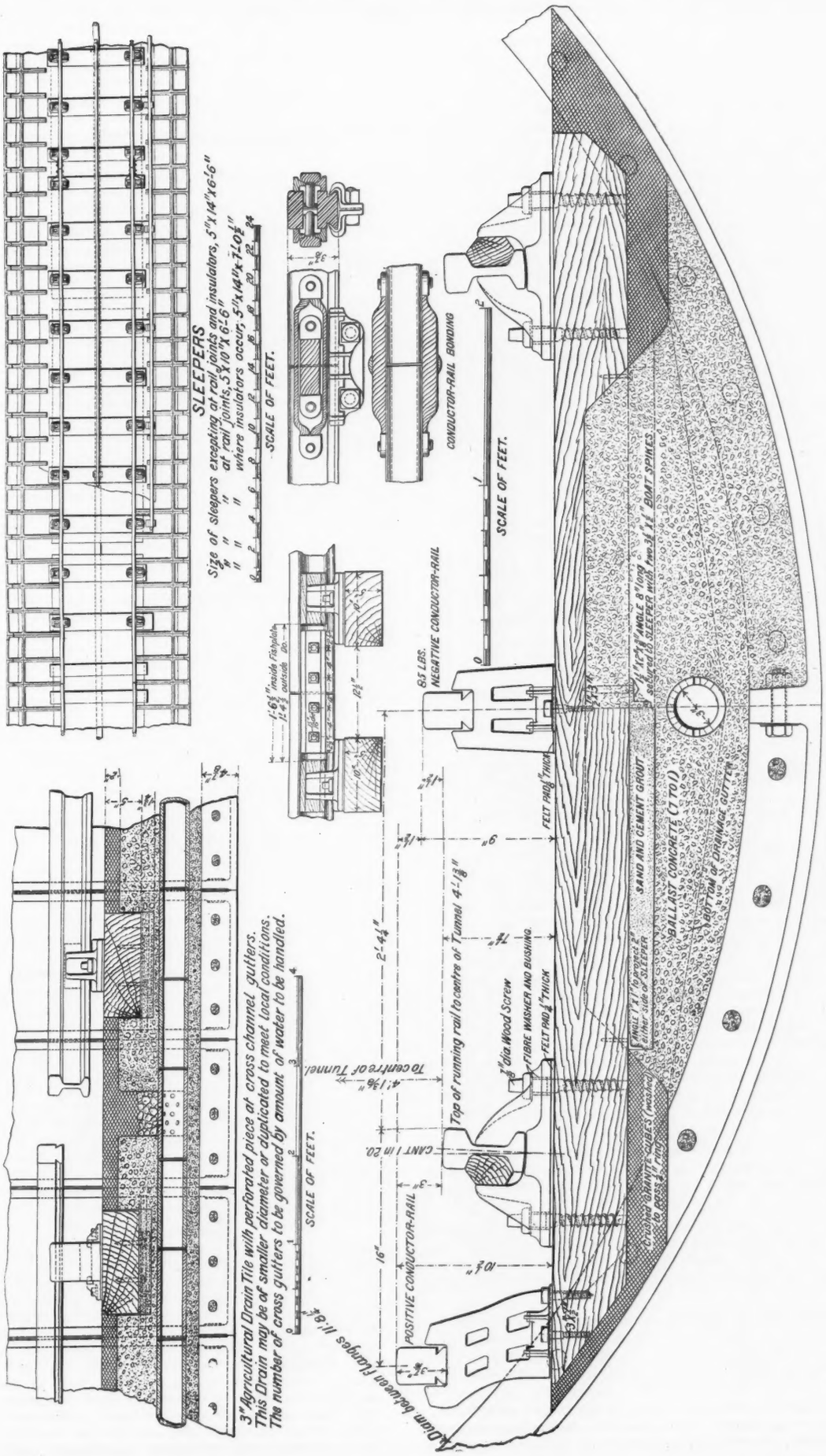
The accompanying drawings show in detail the permanent-way system already in place in the Baker Street & Waterloo Railway, and designed to be generally adaptable for tube railways. The dimensioned drawings show the whole matter so clearly that little else is needed for an understanding of the method designed by Mr. J. R. Chapman, Chief Engineer, for securing such a measure of elasticity and permanence as is desirable under these peculiar circumstances.

The rails are 35 ft. long and weigh 90 lbs. per yard. The reason for making this length of rail is that it is a maximum length which could be lowered down the river shaft, and turned horizontally in the tunnels. The rail section adopted for this purpose is a novel one, but that subject is referred to in another column.

The sleepers are 14 in. wide and laid 40 in. from center to center, so that there is one of these 14-in. sleepers in each alternate segment of the tube, except where the rail joints occur, and at this point 10-in. sleepers are placed in adjoining segments. The sleeper timber is Australian karri.

Both the positive and negative conductor rails rest upon glazed stone wire insulators. The flexible bonding is indicated in the drawings with terminals on the "Crown" principle, wherein the drift-pin is driven from the face of the bond. There are four bonds to each joint—that is, two bonds on each side of the rectangular rails, and the terminals of all bonds are 1 in. in diameter.

The support for the sleepers is, so far as the writer knows, absolutely novel. The drawings show a rigid support of sand and cement grout and of ballast concrete for the middle portion of the sleepers between chairs, also a comparatively elastic support of broken stone ballast underneath the running rails. Permanent way engineers will examine the details in our drawings with much interest, and they will probably note in the first instance that it departs radically from any previous practice, and is also apparently not in accordance with a basis principle in the making of railroad roadbed, in that it furnishes a rigid support for the sleepers for quite nearly the entire distance between the running rails, and at the same time leaves the load on the running rails to be carried upon the somewhat elastic and varying support of broken stone ballast. That is to say, the engineer will at once say that this is a "center-bound" track. The sand and cement grout gripped about the sleepers, supports the sleeper up to a point quite nearly under the inside of the rail chair, and at this point the grout is finished with an angle iron. At first sight it would appear that this furnishes a weak point where the sleeper, under severe or unusual stresses, at any time when the stone ballast under the rail is not wedged up tight, may be subjected to an undue shearing stress. Nevertheless, anyone inclined to make this criticism on the design must bear in mind that this broken stone ballast under the running rail is in a confined space in a tube in such a way that gravity will aid the ganger in keeping the sleeper well supported by the ballast. It is an experiment whose value, time and service will determine. The sleepers are intended to act as a spring, and karri sleepers are sufficiently strong and elastic to endure the strain, whereas other woods would not be suitable. It is evident that this departure from established practice is made for the purpose of preventing noise and vibration, which might subject the company to the payment of damages to property holders on or near the line. The engineer inclined to follow precedents only will have his fears as to the result of this somewhat bold and certainly novel undertaking, but Mr. Chapman's long experience in track work inclines one to have confidence in his design, and it should be borne in mind


SLEEPERS
Size of sleepers excepting at rail joints and insulators, 5"X14"X6'-6"
" " " at rail joints, 5"X10"X6'-6"
" " " where insulators occur, 5"X14"X7'-10½"
SCALE OF FEET.
CONDUCTOR-RAIL BONDING
SCALE OF FEET.
85 LBS. NEGATIVE CONDUCTOR-RAIL
FELT PAD ⅛" THICK
SAND AND CEMENT GROUT
BALLAST CONCRETE (1 TO 6)
BOTTOM of DRAINAGE GUTTER
Top of running rail to centre of Tunnel 4'-1⅜"
⅝" dia. Wood Screw
FIBRE WASHER AND BUSHING.
FELT PAD ⅛" THICK
To centre of Tunnel
CANT 1 in 20.
POSITIVE CONDUCTOR-RAIL
Drain between Lugnos 11 & 12
3" Agricultural Drain Tile with perforated piece at cross channel gutters.
This Drain may be of smaller diameter or duplicated to meet local conditions.
The number of cross gutters to be governed by amount of water to be handled.
SCALE OF FEET.

Permanent Way—Baker Street & Waterloo Railway.

that tube conditions are quite different from those which obtain out-of-doors.

In one other respect Mr. Chapman has made a departure. His rail section, not accurately shown in the drawing, does not conform in its essential lines to either the section adopted by the Engineering Standards Committee in England or to the adopted section of the American Society of Civil Engineers. The head of the rail is the American Society standard, the angle under the head being 13 deg. from the horizontal. The upper surfaces at the base of the rails have the same angle of 13 deg. from the horizontal, whereas the Engineering Standards Committee section has an angle of 20 deg. in both places. Undoubtedly Mr. Chapman, in using the 13-deg. instead of the 20-deg. angles at the points where the fishplate is intended to support the joint, has it in mind that the fishplates will be by so much the more enabled to support the joint against vertical stresses—and this is true. But the criticism might be made that the fishplate does little or no useful work in this vertical support at the joints.

Large Output of Anthracite.

The aggregate anthracite coal tonnage for March was 5,745,868 tons, showing that the anthracite operators rushed coal to market in anticipation of a possible strike. The tonnage exceeded that of the corresponding month of 1905 by nearly a half million tons. The Lackawanna was the heaviest gainer, with 237,471 tons, and the Reading second with 131,702 tons. The Lehigh Valley was the only one of the companies to show a falling off, having decreased 73,300 tons. The following table shows the distribution of the tonnage:

	March	
	1906.	1905.
Reading	1,175,941	1,044,239
Lehigh Valley	840,224	913,524
Central of New Jersey	716,872	687,825
Del., Lack & Western	993,153	755,682
Delaware & Hudson	592,850	557,520
Pennsylvania	497,985	405,345
Erie	520,579	493,340
New York, Ontario & Western	256,689	252,925
Del., Susquehanna & Schuylkill	151,575	148,167
Totals	5,745,868	5,257,567

	Feb. 28.	Mar. 31.	Dec.
Coal, at tide shipping points, tons	828,822	693,095	135,727

Manufacturing and Business.

The offices of the erecting department of the Westinghouse Electric & Manufacturing Company for Manhattan Borough have been moved from 111 Broadway to the Fuller Building, corner of 23d street and Broadway.

The Bucyrus Company, South Milwaukee, Wis., is building 61 steam shovels, three railroad wrecking cranes and one railroad pile driver for work at Panama. These are said to comprise all the equipment of this nature so far bought by the Isthmian Canal Commission.

The Holland-American Construction Company, a subsidiary Westinghouse corporation, has the contract to build an electric (trolley) railroad 115 miles long from the German frontier to the North Sea, touching Arnheim, Zaandam, Amsterdam, Utrecht, Rhenen and Zutphen. The cost of the line is estimated at $5,000,000, and it is designed to carry both freight and passengers.

The Westinghouse Machine Company, of East Pittsburg, received orders during February and March for 35 steam turbines, aggregating approximately 50,000 brake horse-power capacity. The most important equipments were those ordered by the Transit Development Co., Brooklyn, 7,500 k.w.; Toledo Gas & Electric Co., 3,000 k.w.; Los Angeles Pacific Railway Co., 2,750 k.w.; Detroit United Railways, 1,200 k.w.; Columbia (S. C.) Electric Street Railway Co., 3,000 k.w.; St. Paul Gas Light Co., 1,500 k.w.; Grand Trunk Railroad Co., for St. Clair Tunnel, 3,000 k.w.; Detroit, Monroe & T. S. L. Ry., 1,200 k.w.; Northern Heating & Electric Co., St. Paul, 1,000 k.w., and Griffin Wheel Co., Chicago, 1,000 k.w.

Iron and Steel.

The Grand Trunk Pacific has given a contract to the Algoma Steel Co., of Sault Ste. Marie, for 50,000 tons of 80-lb. rails, delivery to be commenced during the present year.

The New York Central has given an additional order for 20,000 tons of rails to the Lackawanna Steel Co., for 1906 delivery. The Southern Pacific has also closed an order for 25,000 tons. Eastern mills have been given orders aggregating about 5,000 tons in addition.

The Carnegie Steel Co. has let the contract for putting up two large blast furnaces at Rankin, Pa. They will cost about $2,000,000. Each will be 100 ft. high and 23 ft. in diameter at the base, and will have a capacity of 500 to 600 tons a day. It is expected to have them completed by the first of next year.

Alfred H. Merritt, of Duluth, Minn., of the Duluth Iron Works; J. Will Smith, of Los Angeles, who owns mines in the Lake Superior region, and Henry Hewitt and associates, of Tacoma, Wash., are planning to build at Tacoma, Wash., a steel plant to cost $5,000,000, and to employ about 5,000 men. A railroad is to be built by the new company to coal fields, which it already owns. It is expected to have the work completed within two years.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

Canadian Society of Civil Engineers.

At a meeting of this society April 19 a paper on "Stresses in Rivetted Connections" was read by C. R. Young.

Southern & Southwestern Railway Club.

At a meeting of this club April 19 in Atlanta, Ga., a paper on "Thermit Welding," by R. P. C. Sanderson, was presented.

Engineers' Club of Philadelphia.

At the meeting of this club, to be held April 21, there will be a paper on mechanical integration, with a special reference to the integraph, by C. O. Mailloux. Lantern views will be shown.

American Society of Civil Engineers.

At the meeting of this society April 18 the subject was "a complete analysis of general flexure in a straight bar of uniform cross section," a paper by L. J. Johnson being presented for discussion. This paper was printed in the Proceedings for February, 1906.

Western Railway Club.

The April meeting was held at the Auditorium Hotel, Chicago, Thursday evening, April 17, at 8 o'clock. The paper for discussion was "A Comparative Test Between a Simple and Compound Locomotive," by Mr. J. F. DeVoy, Mechanical Engineer of the Chicago, Milwaukee & St. Paul Ry.

American Railway Association.

The spring meeting of this Association will be held at the Auditorium Hotel, Chicago, on Wednesday, April 25. Reports will be presented by the Committees on Train Rules, on Car Service, on Safety Appliances, on Statistical Inquiry, on Standard Cipher Code, and on Transportation of Explosives. The election of a President and a Second Vice-President will take place at this meeting, and two members of the Executive Committee, three of the Committee on Train Rules, and three of the Committee on Nominations are to be elected.

Transportation and Car Accounting Officers.

The Association of Transportation and Car Accounting Officers will hold its May meeting at the Adams Hotel, Denver, Colo., on Thursday, May 17. Reports will be made by the Executive Committee, Committee on Per Diem, Committe on Car Service, Committee on Office Methods and Accounting, Committee on Handling Railroad Service Mail, and Committee on Conducting Transportation. A cordial invitation is extended to railroad officials interested in Transportation, Car Service and Car Accounting subjects to be present. The Secretary is G. P. Conard, 24 Park Place, New York; President, H. L. Hunter.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

St. Louis & San Francisco.—A. S. Greig has been appointed Assistant to the President, with office at St. Louis, Mo. Mr. Greig was on the Denver & Rio Grande from 1885 to 1896, acting successively as secretary to the Purchasing Agent, secretary to the Superintendent of Machinery, and secretary, chief clerk and assistant to the General Superintendent. He then went to the Santa Fe, Prescott & Phœnix as trainsmaster. After two years he was appointed Superintendent of the El Paso & Northeastern. He was later made General Superintendent and Traffic Manager, and then Assistant General Manager. In March, 1903, he retired from railroad service and engaged in other work until January, 1904, when he was assigned special duties in the office of the President of the Chicago, Rock Island & Pacific, where he has been until his recent appointment.

Operating Officers.

Central New England.—O. M. Laing, who was recently appointed Superintendent of this road, was born in 1872 at London, Ont. He entered railroad service in 1890 as a clerk in the Auditing Department of the Chicago, Burlington & Northern. The next year he went into the Assistant General Manager's office of the St. Paul & Duluth, becoming, in 1893, chief clerk of that office. In 1898 he was made cashier of the Seattle & International, later becoming also Purchasing Agent. In 1900 he was appointed Chief Clerk to the Superintendent of the Seattle division of the Northern Pacific, and after two years went to the Tennessee Central as Purchasing Agent and General Storekeeper. Later he was appointed also Assistant to the General Manager and was also elected Secretary. In December, 1905, he went to

the Central New England as Assistant Superintendent at Poughkeepsie, N. Y., from which position he was promoted to his present office.

Denver, Northwestern & Pacific.—G. R. Simmons has been appointed Assistant General Manager.

Interoceanic of Mexico.—F. W. Baldwin, Superintendent of Transportation, has resigned, effective May 1.

Missouri Pacific.—W. C. Watrous, Superintendent of Transportation, has resigned.

New Orleans & Northeastern.—S. E. Flanagan has been appointed Assistant Superintendent.

Traffic Officers.

Coal & Coke.—I. K. Dye has been appointed General Freight and Passenger Agent, with office at Elkins, W. Va.

Delaware, Lackawanna & Western.—T. W. Lee, General Passenger Agent, has resigned, the resignation to take effect July 1, on account of ill health.

Oregon Railroad & Navigation.—See Southern Pacific.

Southern Pacific.—James Horsburgh, Jr., Assistant General Passenger Agent at San Francisco, has been appointed General Passenger Agent, with office at that city. Paul Shoup, Assistant General Freight Agent of the Oregon R. R. & Navigation, succeeds Mr. Horsburgh.

Engineering and Rolling Stock Officers.

Atlantic Coast Line.—C. L. Meister, who was recently appointed Mechanical Engineer, graduated from Stevens Institute of Technology in the class of 1897. He began railroad work in the fall after graduation as a rodman on the Metropolitan Street Railway. After a few months he went into the Susquehanna shops of the Erie as a special apprentice, where he remained for two years. He was then draftsman until the end of 1901, when he went to the New York Central & Hudson River for a year. In 1902 he was appointed Chief Draftsman on the Atlantic Coast Line, where he has been until his recent promotion.

Chicago, Rock Island & Pacific.—W. C. Armstrong, hitherto Assistant Engineer of Construction of the Missouri Pacific, has been appointed Bridge Engineer. L. B. Holt, Assistant Division Engineer at Davenport, Iowa, has resigned to go to the Lake Shore & Michigan Southern.

Coal & Coke.—C. E. Turner has been appointed Superintendent of Motive Power.

New York Central & Hudson River.—J. C. Brackenridge has been appointed Consulting Engineer, in connection with electrification.

Purchasing Agents.

Coal & Coke.—J. A. Emmart has been appointed Purchasing Agent.

LOCOMOTIVE BUILDING.

The New York, Chicago & St. Louis is in the market for 15 locomotives.

The Manitou & Pike's Peak has ordered one locomotive from the Baldwin Locomotive Works.

The Pacific Portland Cement Co. has ordered one six-wheel switching locomotive from the Baldwin Works.

The Alafia, Manatee & Gulf Coast is in the market for five locomotives for immediate delivery. Address L. N. Foots, General Manager, Hull, Fla.

The State Board of Prison Directors, 331 Pine street, San Francisco, Cal., will receive bids up to April 30 for one 36-in. gage six or 10-ton contractor's locomotive.

The Boston Consolidated Mining Co. has ordered one 36-in. gage simple four-wheel locomotive from the H. K. Porter Co., for May delivery. The total weight of this locomotive is 18 tons, and has a working steam pressure of 150 lbs.

The Lehigh & Hudson River, as previously reported, has ordered one passenger locomotive, one light Consolidation locomotive, and four heavier consolidation locomotives from the Baldwin Locomotive Works. The latter are to weigh 286,000 lbs. each, including tender.

The A. B. Kaiser Co., Philadelphia, is in the market for eight standard gage six-wheel or eight-wheel switching locomotives. The specifications call for simple locomotives, with at least 80,000 lbs. on drivers; cylinders from 18 in. x 22 in. to 20 in. x 26 in.; diameter of drivers, 4 ft.; straight top boiler preferred, with a working steam pressure of 140 lbs. or over; tank capacity, 3,000 gallons or over; coal capacity, 5,000 tons or over; wheel base is not to exceed 11 ft. 6 in.

The Lima Locomotive & Machine Co. report the following orders for Shay locomotives for the past week: The Cook-Day Lumber Co., New Orleans, one 20-ton locomotive; the Pacific Lumber Co., San Francisco, one 55-ton locomotive; the American Lumber Co., Mobile, Ala., one 65-ton locomotive; the Copp Lumber Co., Shabuta, Miss., one 28-ton locomotive; the McGowan Co., Shivers, Miss., one 20-ton locomotive; the Blind River Transportation Co., Blind River, Ont., one 28-ton locomotive; the Raleigh & Southport Railway Co., Raleigh, one 70-in. x 20-in. consolidation locomotive.

The Wabash, as reported in our issue of April 13, has ordered 30 simple Consolidation (2-8-0) locomotives and 30 simple Prairie (2-6-2) locomotives from the Baldwin Locomotive Works, and 20 simple six-wheel switching (0-6-0) locomotives from the American Locomotive Co., all for July, August and September delivery. The Consolidation locomotives will weigh 214,000 lbs., with 191,000 lbs. on the drivers; cylinders, 22 in. x 30 in.; diameter of drivers, 58 in.; radial stay boiler, with a working steam pressure of 200 lbs.; 375 charcoal iron tubes, 2¼ in. in diameter and 14 ft. 6 in. long; steel firebox, 109 in. x 69 in.; tank capacity, 8,000 gallons, and coal capacity, 14 tons. The Prairie locomotives will weigh 208,000 lbs., with 151,000 lbs. on the drivers; cylinders, 22 in. x 28 in.; diameter of drivers, 70 in.; radial stay boiler, with a working steam pressure of 210 lbs.; 301 charcoal iron tubes, 2¼ in. in diameter and 19 ft. long; steel firebox, 109 in. x 73 in.; tank capacity, 8,000 gallons, and coal capacity, 16 tons. The switching locomotives will weigh 150,000 lbs.; cylinders, 21 in. x 26 in.; diameter of drivers, 52 in.; straight top boiler, with a working steam pressure of 180 lbs.; heating surface, 2,352 sq. ft.; 254 charcoal iron tubes, 2¼ in. in diameter and 15 ft. long; steel firebox, 72 in. x 60 in.; grate area, 30 sq. ft.; tank capacity, 4,500 gallons, and coal capacity, seven tons. The special equipment for all includes: Westinghouse air-brakes, Wabash standard bell ringer and headlights, magnesia sectional boiler lagging for Consolidation and Prairie locomotives and asbestos cement boiler lagging for switching locomotives, Waycott brake-beams and Perfecto brake-shoes for Consolidation and Prairie locomotives, Climax steel couplers, Wabash standard journal bearings for Consolidation and Prairie locomotives, Lewis & Kunzer piston and valve rod packings, Crosby safety valves, Leach sanding devices, Detroit sight-feed lubricators for Consolidation and Prairie locomotives and Chicago sight-feed lubricators for switching locomotives, Railway Steel-Spring Co.'s springs, Crosby steam gages, Gold Car Heating & Lighting Co.'s steam heat equipment for Prairie locomotives, and Standard Steel Works driving and truck wheel tires.

CAR BUILDING.

The Rutland, it is reported, has ordered 100 steel cars.

The Coal & Coke is receiving bids for 200 hopper cars.

The Cleveland & Southwestern Traction has ordered 15 additional cars.

The National of Mexico, it is reported, has ordered 200 additional box cars from the American Car Co.

The Barrett Manufacturing Co., Chicago, has ordered 14 tank cars from the Bettendorf Axle Co., for April delivery.

The Toledo & Ohio Central has ordered three cafe cars and seven day coaches from the Pullman Co. for August delivery.

The Mississippi River & Bonne Terre is in the market for 1,000 box cars of 80,000 lbs. capacity, and 200 box cars of 60,000 lbs. capacity.

The Egyptian Government, it is reported, will shortly order a number of passenger and freight cars. Address Major J. H. L'E. Johnstone, Cairo, Egypt.

The Atchison, Topeka & Santa Fe, it is reported, has ordered 60 steel underframe smoking cars and 200 gondola cars from the American Car & Foundry Co.

The Alafia, Manatee & Gulf Coast is in the market for 100 ventilated box cars and additional passenger equipment for immediate delivery. Address L. N. Foots, General Manager, Hull, Fla.

The Pennsylvania, it is reported, has recently placed an order for 616 freight cars. Five hundred and forty-six of these are to be built by the Pressed Steel Car Co., and the remaining 70 were ordered from the American Car & Foundry Co. Delivery, it is stated, is to be made this summer.

The Illinois Central has ordered 1,000 composite box cars of 80,000 lbs. capacity from the Standard Steel Car Co., for October and November delivery, and will build 531 box cars of 80,000 lbs. capacity at its Burnside shops, for July and August delivery, to fill vacancies in the company's authorized equipment. The composite box cars will weigh 41,500 lbs., and the other box cars will weigh 37,500 lbs. All cars will be 36 ft. long, 8 ft. 6 in. wide and 8 ft. high, all inside measurements.

The Denver City Tramway has ordered 12 standard side opening passenger cars and two closed cars from the Woeber Carriage Co., for June delivery. The side opening cars will weigh 38,000 lbs., and measure 43 ft. 3 in. long, over all; 8 ft. 4 in. wide, outside over belt rail, and 12 ft. 6 in. high from rail to trolley base. The closed cars will weigh about 39,000 lbs., and measure

44 ft. 5 in. long, over all. The special equipment for both includes: Christie type cast brake-shoes, Westinghouse brakes, Tomlinson Coupler Co.'s couplers, Forsyth curtain fixtures, Pantasote curtain material, Dorner trucks and Griffin Wheel Co.'s wheels. Other specialties are Nichols-Lintern air sanders.

The Chicago & Alton, as reported in our issue of April 13, has ordered 500 box cars of 80,000 lbs. capacity for October and November delivery; 250 stock cars of 60,000 lbs. capacity, and 250 flat cars of 80,000 lbs. capacity for September and October delivery. All of the box cars will be 40 ft. long x 8 ft. 6 in. wide by 8 ft. high, inside measurements. The stock cars will be 36 ft. 6 in. long x 8 ft. 9 in. wide by 8 ft. high, inside measurements. The flat cars will be 41 ft. 10 in. long by 9 ft. wide over all. The special equipment for all includes: Simplex bolsters, American Brake-Shoe & Foundry Co.'s brake-shoes, Spiral brasses, Climax couplers, Security door fastenings for box cars, Miner draft rigging, National journal boxes, and Railway Steel Spring Co.'s springs.

BRIDGE BUILDING.

Acca, Va.—The Richmond, Fredericksburg & Potomac will build a two-span iron bridge 100 ft. long, with approaches at each end of 100 ft. at Hill Monument avenue, at a cost of $20,000.

Atlanta, Ga.—At a special meeting of the General Council the Bridge Committee reported favorably on the construction of the Washington street viaduct. Work on the improvements is to be started at once. Under the terms adopted by the council the viaduct will cost $128,370, of which the city will pay $69,370, and the railroads $59,000. Contracts have been let to Grant Wilkins to built that part of the viaduct extending from East Hunter street to the northern end of the railroad tracks for $66,180, and the remainder of the viaduct to the Oliver Company, extending as far as Gilmar street, at $60,190.

Bath, Ont.—Bids are wanted by Max Robinson, Town Clerk, for building a steel bridge here.

Baton Rouge, La.—Announcement has been made that a company is being organized in New Orleans to obtain permission from Congress to build a bridge across the Mississippi river near this place.

Cap Rouge, Que.—A contract has been given to the Dominion Bridge Co., of Montreal, at $318,000 for building the 3,000 ft. steel viaduct over the Cap Rouge Valley near Quebec, for the Grand Trunk Pacific. Other bids were Locomotive & Machine Co., $331,000; Grand Trunk Pacific, $347,000, and Phoenix Bridge Co., $348,000.

Castlewood, S. Dak.—Bids are wanted May 8 by the County Commissioners for building six steel bridges over the Sioux river in Hamlin County. William Marshall is County Auditor.

Dayton, Ohio.—Plans are being made for building a concrete bridge over the Miami river. Three of the railroads which are interested are making independent plans for the same structure.

Desmet, S. Dak.—Bids are wanted May 16 by J. O. Purintin, County Auditor, for building a steel bridge 60 ft. long over the Vermillion river in Kingsbury County.

Forest, Ont.—Bids are being received by R. Kan, Village Clerk, for building several steel bridges.

Galveston, Tex.—A joint company is being formed by the railroads to build a stone causeway for two tracks from Galveston Bay to connect the island with the main line. The Missouri, Kansas & Texas and the Gulf, Colorado & Santa Fe are ready to join in this work, and if the Southern Pacific will co-operate construction will be started at once.

Greenbay, Wis.—The Chicago & North-Western Railroad bridge over the Fox river at this place is to be rebuilt at a cost of $1,000,000. Nine of the concrete piers will be replaced.

Haverhill, Mass.—The Miller-Collins Co., contracting engineers, of New York, tell us they have given a contract for the general work, piers, etc., at approximately $250,000, in connection with the new Haverhill bridge over the Merrimac river.

Jackson, Ky.—A contract has been given to the Central States Bridge Co. to build a steel bridge 185 ft. over the Kentucky river, to replace the structure recently carried away by the flood.

Newark, N. J.—Plans for a bridge at Clay street have been completed by the engineers of Essex and Hudson counties and approved by the Joint Bridge Committee. The plans call for a structure 320 ft. long, with an opening of 75 ft. The bridge is to be 56 ft. wide and is to cost about $150,000.

Peterborough, Ont.—Bids are being received by E. M. Elliott for building two steel bridges over the Indian river.

Portland, Ind.—A contract has been given to C. E. Walker for building a steel bridge, with concrete abutments, over the Salamonte river.

Revere Beach, Mass.—The Boston, Revere Beach & Lynn and the Boston & Maine will pay part of the cost of a steel bridge over the tracks. The Boston Bridge Works has the contract for the iron and steel. The cost of the work will be about $10,000.

Rutherfordton, N. C.—The County Commissioners have given contracts to the Virginia Bridge & Iron Co., of Roanoke, Va., and the Cope Bridge Co., of Chattanooga, Tenn., for building five steel bridges in Rutherfordton County, at a total cost of about $12,000.

Salina, Pa.—Bids are wanted May 2 at the office of the Superintendent of Public Grounds and Buildings, Harrisburg, Pa., for rebuilding the substructure and superstructure of the bridge over the Kiskiminitas river at this place. John M. Shumaker is Superintendent.

San Juan, Porto Rico.—The Bureau of Public Works of the Department of the Interior is asking bids May 19 for a steel-riveted pony truss highway bridge of 109 ft. span. Plans may be also seen at the Porto Rico Commercial Agency, 91 Wall street, New York. J. J. Jiminez is Superintendent of Public Works.

Toledo, Ohio.—The Council Committee at a recent meeting approved the building of a river bridge at Cherry street, to be of reinforced concrete 82.5 ft. wide, with a lift draw.

Valparaiso, Ind.—Bids are wanted May 7 by S. P. Corboy, Auditor, for building two bridges each 42 ft. long, also two, each 30 ft. long, and one 36 ft. long, all to be of iron, for Porter County.

Other Structures.

Brooklyn, N. Y.—The Delaware, Lackawanna & Western, it is said, has completed negotiations for taking over the properties of the Brooklyn Warehouse & Dry Dock Co. and the Brooklyn Dock & Terminal Co., in South Brooklyn. These are located on the Gowanus canal, extending back to Third avenue and from 24th to 25th streets. The railroad also gets from the first company two dry docks, machine shops, and two slips. From the Terminal company it has bought two large slips and waterfront property, two miles of track, float bridges, warehouses, etc., which have hitherto been used both by the Erie and the Lackawanna.

Enola, Pa.—A contract for making improvements to the shops of the Pennsylvania here, it is said, has been let to J. N. Bastress & Co., of Harrisburg.

Macon, Ga.—The Central of Georgia, it is said, is planning to put up a new freight house at the corner of Fifth and Cherry streets, and to make other improvements at a cost of about $500,000. The company is also considering the question of putting up new shops here.

New York, N. Y.—The Lehigh Valley has applied for permission to the Department of Docks and Ferries to build a steel freight shed on the bulkhead between 124th and 125th streets, East river.

Philadelphia, Pa.—The Baltimore & Ohio has let contracts for the erection of a machine shop, transfer shed, roundhouse, water tanks and other work in connection with the extensive East Side terminal improvements, to Roydhouse, Arey & Co. The work will cost between $600,000 and $700,000, including the enlarging of the terminal yards and the laying of a large amount of new track. The new buildings and yard improvements will be at Moore, Jackson and 36th streets and the Schuylkill river, and considerable filling will be required. The buildings include a machine shop 60 ft. x 120 ft.; blacksmith shop, 60 ft. x 70 ft., with engine and boiler room; trainmen's and shopmen's building, of brick, two stories high, 85 ft. x 35 ft.; yard office, two stories, 34 ft. x 40 ft.; transfer shed and platform with rolling steel doors; 25-stall roundhouse, 400 ft. in diameter; 80-ft. turn-table pit; store house with oil house, 106 ft. x 40 ft. and 35 ft. x 40 ft. respectively; offices and platform; sand house, coal tipple and approach; ash pit; water tanks; brick stack, 125 ft. high; bolt shed and locker room. Considerable car repair work will be done in the new shops.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Atchison, Topeka & Santa Fe.—On the Belen cut-off the western section has been completed from Belen, N. Mex., east to Vaughn, about 120 miles. The line crosses the Santa Fe Central at Willard and connects with the El Paso & Southwestern at Vaughn. On the eastern end the cut-off is completed from Texico west to the Pecos river, about 76 miles, and work is being pushed on the remaining section, west 58 miles to Vaughn.

Cairo & Thebes.—Capital has been secured by this company for building its proposed road, and location surveys are now being made. Contracts for the work are to be let early in June. The proposed route is from Cairo to Thebes, Ill., 25 miles. The terminal at Cairo, which will be in the middle of the city, will include a large passenger and a freight station, a round-house, coaling facilities and yards. E. A. Smith, of Cairo, is President.

Canadian Northern.—A contract has been given to J. D. MacArthur, of Winnipeg, for grading an extension of this road from Wayburn, Sask., to Stoughton. Work is to be started at once.

CANADIAN PACIFIC.—This company has made appropriations for improvements to its lines in the Province of Alberta as follows: Between Calgary and Laggan, $10,000; on the Edmonton branch, $35,000; on the McLeod branch, $75,000; other work, $65,000.

A contract has been let to Hargrave Bros., of Winnipeg, to grade 40 miles of this company's branch line from Stoughton, on the Moose Mountain section, to Weyburn. Work is to be started at once and finished this fall. The line will extend over a level section, and run through some of the finest farming lands in the province.

CHESAPEAKE & OHIO.—This company, it is said, will spend about $1,000,000 double-tracking various parts of its road. Some of the work is to be done between Richmond and Newport, Va., and the balance near Maysville, Ky.

CHICAGO & NORTH-WESTERN.—This company is planning to make improvements on its Iowa division at a cost of $320,000. The work includes the installation of Hall block signals between Clinton and Otis, and Logan to Council Bluffs, together 115 miles.

CHICAGO, ROCK ISLAND & PACIFIC.—Official announcement has been made by this company that it will spend during the present summer $1,250,000 for improvements on its main line between Davenport, Iowa, and Council Bluffs. About 50 miles will be reballasted, and the sections between Newton and Colfax, Booneville and Earlham, and Menlow and Atlantic, will be entirely rebuilt. All the bridges, about 20 in number, are to be strengthened or rebuilt. The work also calls for the laying of 250,000 new oak ties and the building of 50,000 rods of fence. About 2,500 yards of crushed stone will be used for rip-rapping embankments where there is danger from overflowing streams.

See St. Louis & San Francisco.

CHICAGO, MILWAUKEE & ST. PAUL.—A contract is reported let by this company to P. E. Shugart, of Nevada, for grading 180 miles on its extension west from the Missouri river in Dakota.

COLORADO ROADS.—George N. Davenport and others are planning to build an electric road from Golden, Colo., to the top of Lookout Mountain, 7,000 ft. above the sea level. The proposed route is along the side of the hill for a distance of 11 miles. No bridges will be required. The total rise from the starting point to the terminus on the mountain will be about 1,420 ft.

CRAWFORD BAY & ST. MARYS.—This company, which has been granted permission to build a line from Crawford Bay to Fort Steele, B. C., is seeking authority to build an extension 200 miles beyond Fort Steele to Lethbridge. The route through the rockies will pass either north or south of Kootenay Pass.

GRAND TRUNK PACIFIC.—Contracts have been let by the Dominion Government for building two sections of this road, as follows: The western section from Winnipeg east to Peninsula crossing near the junction point of the Fort William branch, 245 miles, to J. D. McArthur, of Winnipeg, at 24 cents a yard for earth and $1.60 for rock; estimated total, $13,010,000. This was about $250,000 below the estimate of the government engineers. Other bids were: Pacific Construction Co., $13,028,000; McArthur Construction Co., $17,048,000, and Grand Trunk Pacific, $13,991,000. The contract for the eastern section is from the north end of the Quebec bridge in Quebec, to a point near La Tuque, 150 miles, to Hogan & McDonald, of Montreal, at 21 cents a yard for earth and $1.44 for rock, or $5,297,000. This is $750,000 below the engineers' estimate. Other bids were: O'Brien & Mullarky, $5,550,000; Grand Trunk Pacific, $6,459,000; M. P. Davis & J. T. Davis, $6,667,000; McConnolly, Jardine & Wilson, $7,081,000, and McArthur Construction Co., $7,940,000. Both these contracts were let to the lowest bidders. The work includes the grading and construction of bridges, but not the rails; and provides that all materials, machinery and supplies shall be of Canadian production as far as possible. The work is to be completed by October 1, 1907. Between these two sections there is a gap of 1,000 miles on which work will probably not be started until the Fort William branch has been built, and the Temiskaming & Northern Ontario extended to Lake Abitibi.

The first definite construction work for this road on the Pacific coast was commenced at Kaien Island, where the British Columbia Pine Timber Co. is erecting a saw mill to cut 50,000,000 ties, being the first order for the British Columbia section of the line. The ties are to be delivered at Port Rupert, B. C.

HIDALGO & NORTHERN.—See Missouri, Kansas & Texas.

ILLINOIS VALLEY RAILWAY (ELECTRIC).—Bids are wanted by this company at its office in Lasalle, Ill., for grading 19 miles of its road. The work includes the excavation of 200,000 cu. yds. of earth and building 1,500 yards of concrete.

INDIANA, COLUMBUS & EASTERN TRACTION.—Incorporation has been asked for by this company, with a capital of $1,000,000, in Ohio. The organizers propose to take over the Tucker-Anthony & Appleyard rights, which were recently bought by a syndicate of which W. J. Schoepf was the head. The new owners are planning to build a line from Dayton southeast to Richmond, Ind., 100 miles air line. Negotiations for buying the Dayton & Western, which operates between these two points, have been abandoned.

LAKE ERIE TERMINAL & SOUTHERN (ELECTRIC).—An officer writes that a contract has been given by this company to the Terminal Traction Co., 406 American Trust Building, of Cleveland, for building its proposed electric road from Cleveland, Ohio, south to Akron, about 35 miles; and track has been laid for five miles. The work includes the building of two large bridges. H. B. Camp is President, and R. J. Wood, Chief Engineer.

LEHIGH VALLEY.—Under the name of the Lehigh & Lake Erie, which was granted a charter some years ago, this company will build a line 10 miles long around Buffalo, N. Y. The proposed line will touch the Lackawanna Steel Co.'s plant and continue to where the Lake Shore and the terminal road of the New York Central connect. It will cross the Lake Shore, the Erie, the Pennsylvania and the Nickel Plate, and thence by William street to a connection with the main line of the Lehigh Valley.

LEHIGH & LAKE ERIE.—See Lehigh Valley.

LOUISVILLE, HENDERSON & ST. LOUIS.—An officer writes that this company is not making any important changes in its structures beyond the substitution of a few concrete culverts and earth fills for trestles and the reinforcing of some of the older steel structures. The new work to be carried out includes a small freight yard in Louisville, to include about two miles of track. This is between Main, Market, 13th and 14th streets. The yard will have six tracks each for outbound and incoming cars, and will include a house and team tracks. The contract for building the freight house was let in February to Lortz & Fray, of Louisville.

LOUISVILLE, SOUTH PITTSBURG & BIRMINGHAM.—Incorporation has been granted this company in Tennessee, with a capital of $100,000, to build a railroad from Louisville to Birmingham. The incorporators are C. H. Glatzan and E. Ripley, of Pittsburg; J. W. Davis, of Falconer, N. Y., and J. A. Shillito, of Crossville, Tenn., and others.

MINNEAPOLIS & ST. LOUIS.—Grading has been started on two important extensions of this road in South Dakota. The first is on the new line northwest from Watertown, S. Dak., through Bradley, Aberdeen, and Leola, into McPherson County, 150 miles. The other line will branch off from the Leola line at Conde, following in a westerly direction, toward the Missouri river, for 100 miles.

MINNEAPOLIS, ST. PAUL & SAULT STE. MARIE.—This company has started work on a line from Detroit, Minn., west to Fargo, N. Dak., about 50 miles, paralleling the Northern Pacific.

MISSOURI, KANSAS & TEXAS.—The Hidalgo & Northern is making surveys, and as soon as they are completed will let contracts for building the first section of the proposed line, from the mouth of the Rio Grande to Hidalgo, 60 miles. The M., K. & T. is supposed to be back of this project.

NEVADA & CALIFORNIA.—See Southern Pacific.

NEW YORK, CHICAGO & ST. LOUIS.—This company, it is said, is planning to double track its road between Stony Island and Osborne, Ill., 22 miles, and to build a 20-mile extension near Chicago.

OREGON RAILROAD & NAVIGATION.—A contract is said to have been let by this company to Erickson & Peterson for building 47 miles of its proposed line from Elgin down the Grand Ronde river to the junction of the Wallowa river, and thence up that river to Joseph in the center of the Wallowa valley, about 63 miles. The first 16 miles is being built by contractor McCabe.

PENNSYLVANIA LINES WEST.—The directors have authorized the building of 43 miles of second track on the Pittsburg, Cincinnati, Chicago & St. Louis between Logansport, Ind., and Chicago, which will complete the double track between these points. Work has been begun. On the section between Columbus and Logansport there is double track for about two-thirds of the distance.

PHILADELPHIA, CAMDEN & INTER-CITY LINK.—This company proposes to make a tunnel under the Delaware river from the foot of Walnut street, Philadelphia, to Delaware avenue in Camden, N. J. Soundings already made show that no rock excavation will be required. The Camden Terminal is to be near the present Pennsylvania station. The promoters say that contracts for the work are to be let soon.

PITTSBURG, WESTMORELAND & SOMERSET.—See Western Maryland.

ROCK ISLAND-FRISCO TERMINAL.—See St. Louis & San Francisco.

ST. LOUIS & SAN FRANCISCO.—A charter has been granted to the Rock Island-Frisco Terminal Railroad Co., of St. Louis, with a capital of $5,000,000. The incorporators are: A. J. Davidson, President of the St. Louis & San Francisco; C. A. Gray, H. E. Hand. L. F. Parker and Leroy Kramer. The company was organized to build a railroad from the western boundary of St. Louis, Mo., at the intersection of the Wabash Railroad, thence east and south to a point on the southern city limits between Broadway and the tracks of the St. Louis, Iron Mountain & Southern. The company also intends to secure trackage rights from the Merchants' bridge across the Mississippi river, and to build terminal tracks in St. Clair County, Ill.; also to build to a point on the east bank of the Mississippi river near East Carondelet, 30 miles. The road is intended to provide terminal facilities for the Rock Island system

in St. Louis; and it will connect with the Madison, Illinois & St. Louis Railway.

South & Western.—On the line from Marion, N. C., to Spartansburg, this company has 3,000 men at work. At one point there will be 17 tunnels within a distance of 18 miles.

Southern.—Surveys are being made by this company from Seneca, S. C., to Rosman to locate a cut-off between Asheville, N. C., and Atlanta, Ga.

This company has recently bought the projected Ohio River & Gulf and the Kentucky & Tennessee. The latter had already built 15 miles of road in a southwesterly direction from Stearns in Whiteley County, Kentucky. The new owners are planning to extend this line to Jamestown, which is to be the northern terminus of the Ohio River & Gulf, giving the Southern a direct line between its Tennessee Central division, at Johnson's, Tenn., and its Queen & Crescent route at Stearns, Ky. The new line will be about 60 miles long, and in addition to affording a new and shorter route between Cincinnati and Nashville, will reach a rich coal section. Grading has been commenced on the Ohio River & Gulf end of the line, and work is also under way on the Kentucky & Tennessee division. The section to be traversed is largely level, and construction will not be expensive.

Southern Pacific.—According to Southern Pacific engineers, work will be commenced at once on a branch of the Nevada & California from Hazen, Nev., to Fallon, through the agricultural lands of the Carson Sink, where the Government irrigation works are making much land valuable for farming. The rails are on hand at Hazen.

A supply of rails has been stored at Drain, Ore., for the construction of the first 30-mile section of the Drain-Coos Bay branch, and contracts will soon be let for the grading. Surveys have been completed along the entire route, and for the whole distance from Drain to the coast the ruling grades will be less than 1 per cent. The road will follow the Umpqua river valley.

Tampa & Jacksonville.—See Gainesville & Gulf.

Temiskaming & Northern Ontario.—Bids are wanted by H. W. Pierson, Toronto, April 24, for all the work, except the ballasting and track laying, on an extension of this road from North Bay Junction to Nipissing Junction, about three miles. Also for an extension from North Bay Junction to Regina street in the town of North Bay. Plans may also be seen at the office of the Chief Engineer at North Bay, Ont.

Toronto & York.—This company is seeking permission to extend its railroad to Stouffville, Whitby and Bowmanville, Ont.

Western Maryland.—The Pittsburg, Westmoreland & Somerset, it is said, will be built from Zufali to Somerset, and then taken over by the Western Maryland. This new road will give the Gould interests a connection to the Pennsylvania coal fields.

RAILROAD CORPORATION NEWS.

Atchison, Topeka & Santa Fe.—This company has taken over the Denver, Enid & Gulf, and will operate it as part of its Pan-Handle division. The D., E. & G. runs from Guthrie, Okla., northwest to Kiowa, Kan., 119 miles, and control of it was acquired by the Atchison several months ago. (Jan. 19, p. 22.)

This company has also taken over the Texas & Gulf, which runs from Longview, Tex., to Timpson, 58 miles, and, it is said, will at once build an extension from Timpson 17 miles south to Center, the northern terminus of the Beaumont division of the Gulf, Colorado & Santa Fe.

Bald Eagle Valley.—A stock dividend of 9 per cent. has been declared payable on May 1 to the holders of the $1,535,000 capital stock. The Bald Eagle Valley is leased to the Pennsylvania, and this dividend is in addition to the regular annual dividend of 10 per cent.

Baltimore & Ohio.—The Board of Directors on April 13 authorized an issue of an additional $27,750,000 common stock, the present amount outstanding being $124,558,000. The new stock is to be offered at par to preferred and common stockholders to the extent of 15 per cent. of their holdings on April 27, making the rights worth about $1.50 per share.

Canadian Northern.—It is reported that this company has bought the Central Ontario, which runs from Picton, Ont., to Bancroft, 116 miles. The Central Ontario has been in the hands of a receiver, and there has been litigation as to whether the road could be sold absolutely under the mortgage.

Central Ontario.—See Canadian Northern.

Chicago Terminal Transfer.—J. N. Faithorn, President, has been appointed receiver. The holders of the $16,500,000 first mortgage 4 per cent. bonds of 1947 recently brought suit against the company on the ground that the semi-annual interest had been defaulted three times in succession.

Denver, Enid & Gulf.—See Atchison, Topeka & Santa Fe.

Kentucky & Tennessee.—See Southern.

Long Island.—The New York Stock Exchange has listed an additional $4,517,000 4 per cent. refunding bonds of 1949, making the total amount listed $22,408,000. Of the entire amount, $3,500,000 were issued for the rebuilding of the Bay Ridge division in Brooklyn; $4,500,000 for elimination of grade crossings and similar improvements; $9,020,000 for shop improvements, second and third tracks, additional equipment, electrification of lines and terminal improvements.

Minneapolis, St. Paul & Sault Ste. Marie.—The New York Stock Exchange has listed $6,050,000 first consolidated mortgage 4 per cent. bonds. Of this amount nearly all ($5,860,000) is to pay for the construction of most of the Thief River Falls extension, completed late last year.

National of Mexico.—Speyer & Co., of New York, have bought $3,000,000 4½ prior lien bonds of 1926. This amount completes the $23,000,000 covered by the mortgage. The proceeds are to pay for the Hidalgo & Northeastern.

New York, New Haven & Hartford.—This company has issued an additional $6,750,000 capital stock, making the total amount outstanding $96,036,300. The new stock is to pay for improvements and for subsidiary roads recently acquired.

The company has sold to J. P. Morgan & Co., New York, $15,000,000 4 per cent. non-convertible debentures of 1956. The proceeds will be used for electrification between Woodlawn, N. Y., and Stamford, Conn., and for improvements on the subsidiary roads recently acquired. Mackay & Co. and Lee Higginson & Co., New York, have bought an additional $1,500,000 4 per cent. bonds.

Pacific Coast Company.—This stock has advanced noticeably during the last week and a half, and it seems probable that some of the large systems are trying to get control. The company's terminal property in Seattle would be valuable to any railroad which wished terminal facilities in the city. Therefore it is likely that if the company changes hands it will go to either the Union Pacific or the Chicago, Milwaukee & St. Paul, each of which is to build a line into Seattle. Harriman and Hill interests are both at present represented in the directorate.

Rock Island Company.—It has been officially announced that the Rock Island Company has acquired a half interest in the Trinity & Brazos Valley, a 77-mile line in Texas running from Cleburne south to Mexia. This road is owned by the Colorado & Southern and is building for the Colorado & Southern its gulf extension from Fort Worth to Houston and Galveston. The Trinity & Brazos Valley has trackage rights over the Gulf, Colorado & Santa Fe from Fort Worth to its northern terminus and from Houston to Galveston. When completed, it will furnish a line for both the Rock Island and the Frisco systems to the gulf.

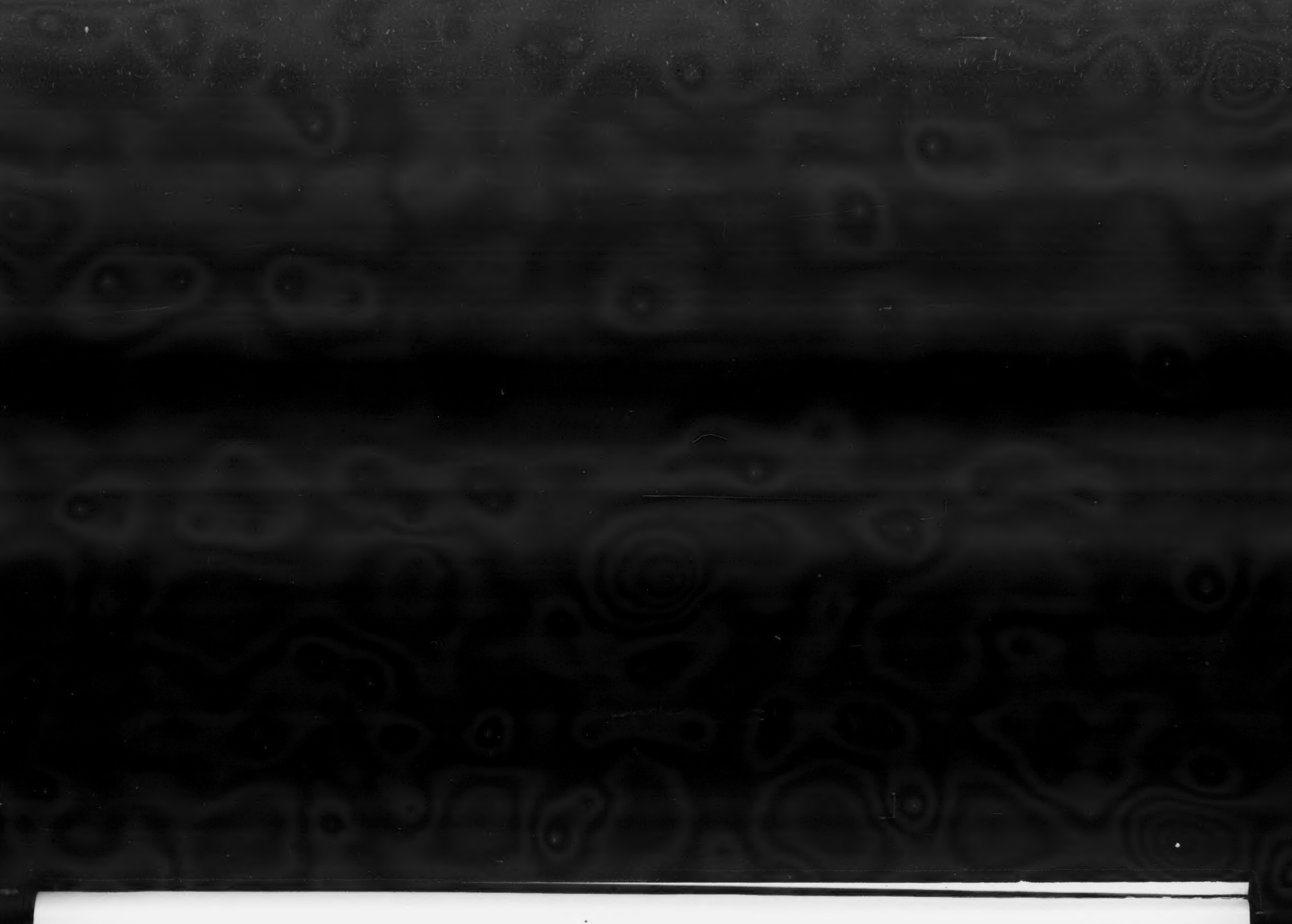
Through its Rock Island, Arkansas & Louisiana line, which now extends south from Little Rock to within 25 miles of Alexandria, La., the Rock Island proposes to build to a connection at or near Eunice or Opelousas, La., with the projected line of the Colorado Southern, New Orleans & Pacific, thus giving a New Orleans connection.

The St. Louis & San Francisco has bought the projected Colorado Southern, New Orleans & Pacific, which is now building a line, including trackage rights, from New Orleans to Houston. To finance the purchase and important needs of the Colorado Southern, New Orleans & Pacific, the St. Louis & San Francisco has sold $7,500,000 five-year, 5 per cent. notes, secured by a deposit of $8,500,000 first mortgage bonds of the Colorado, Southern, New Orleans & Pacific.

Southern.—This company has acquired the Kentucky & Tennessee, which has $100,000 capital stock authorized and $850,000 bonds. It is in operation from Stearns, Ky., to Yamacraw, 15 miles. See Southern under Railroad Construction.

Texas & Gulf.—See Atchison, Topeka & Santa Fe.

Toledo Railway & Terminal Co.—The protective committee representing the holders of the bonds on which interest has been defaulted consists of: A. T. Sullivan, President of the Nassau Trust Co., Brooklyn; R. E. James, President of the Easton Trust Co., Easton, Pa.; Daniel McCoy, President of the State Bank of Michigan, Grand Rapids, and S. C. Eastman, President of the New Hampshire Savings Bank, Concord. A fifth member will be added later.

Union Pacific.—There are now outstanding $1,877,000 first lien convertible 4 per cent. gold bonds and $194,152,900 common stock. The option to convert these bonds expires on May 1, 1906.

Wisconsin Central.—A special meeting of the stockholders has been called for May 8 to vote on the authorization of an issue of $8,500,000 30-year 4 per cent. first mortgage bonds, to be secured by a mortgage on the extension now under construction from Owen, Wis., to Superior and Duluth. Of this amount $7,000,000 will be issued at once, and the remainder will be reserved for improvement of terminals.